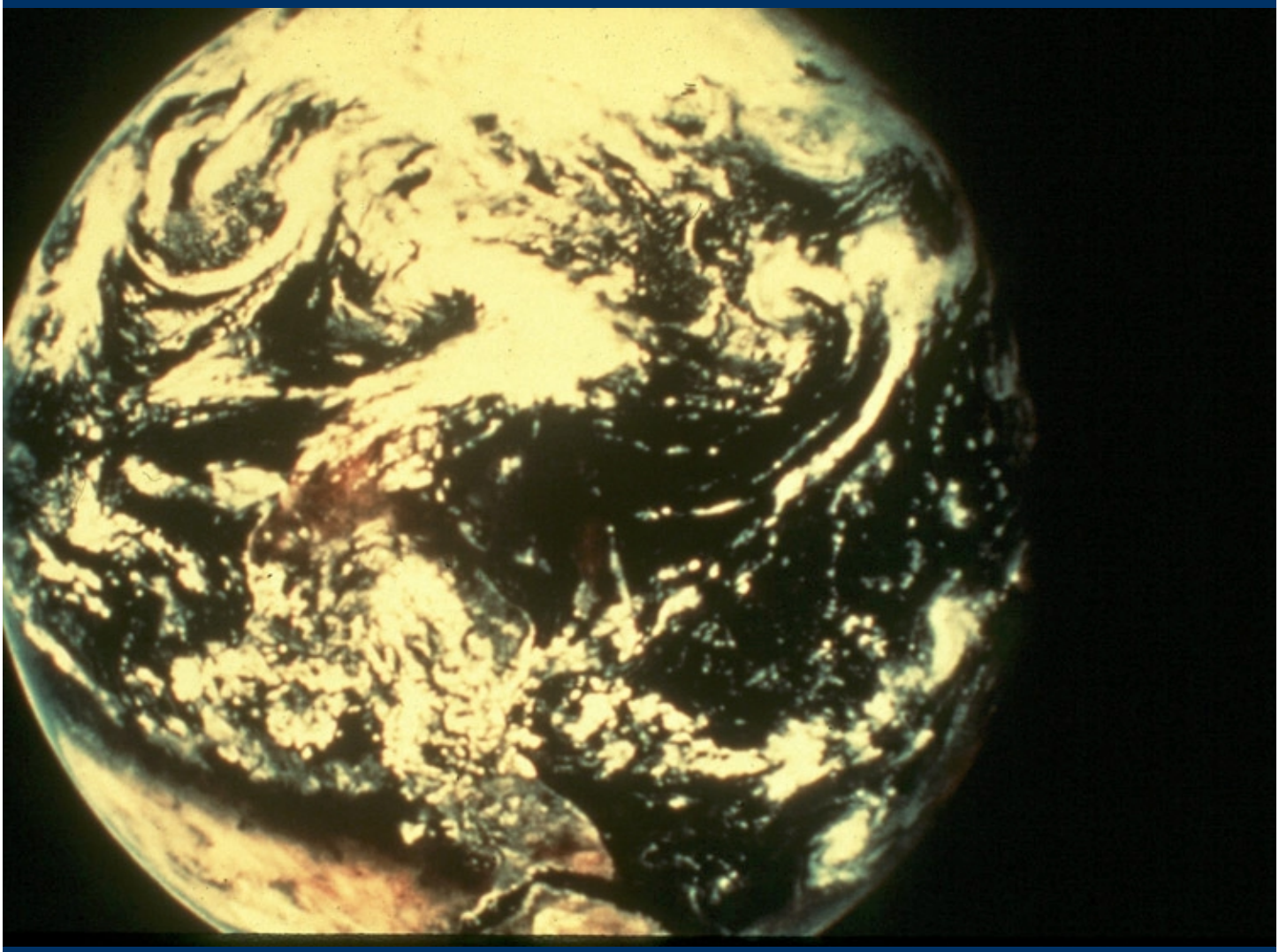

Inyo National Forest, California



Soil horizons - Lamellae


Olympic Peninsula, Washington State

Tumalo Creek
Oregon


Idaho


Pacific Ocean

Smooth Douglasia

Skunk cabbage

Olympic Peninsula


Idaho


Elk herd - Washington State


Alaska

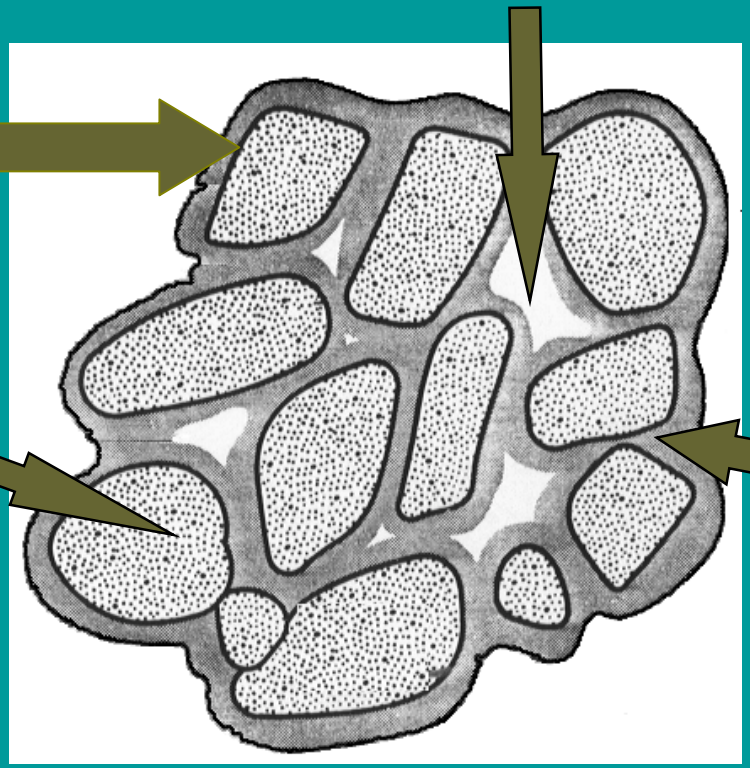
Soil Properties

Solids:

Organic Matter

Minerals (Soil Particle)

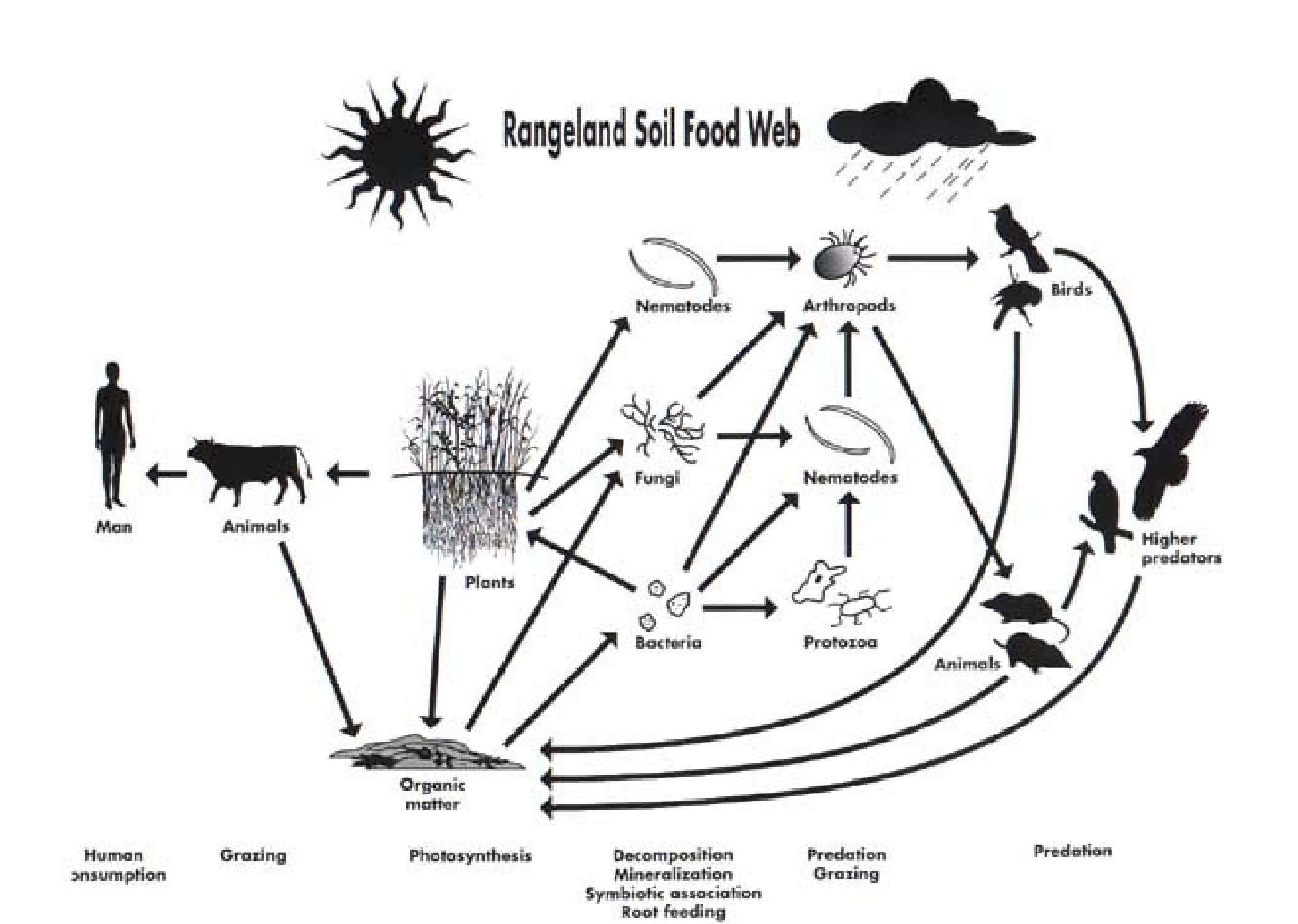
Gas-Air



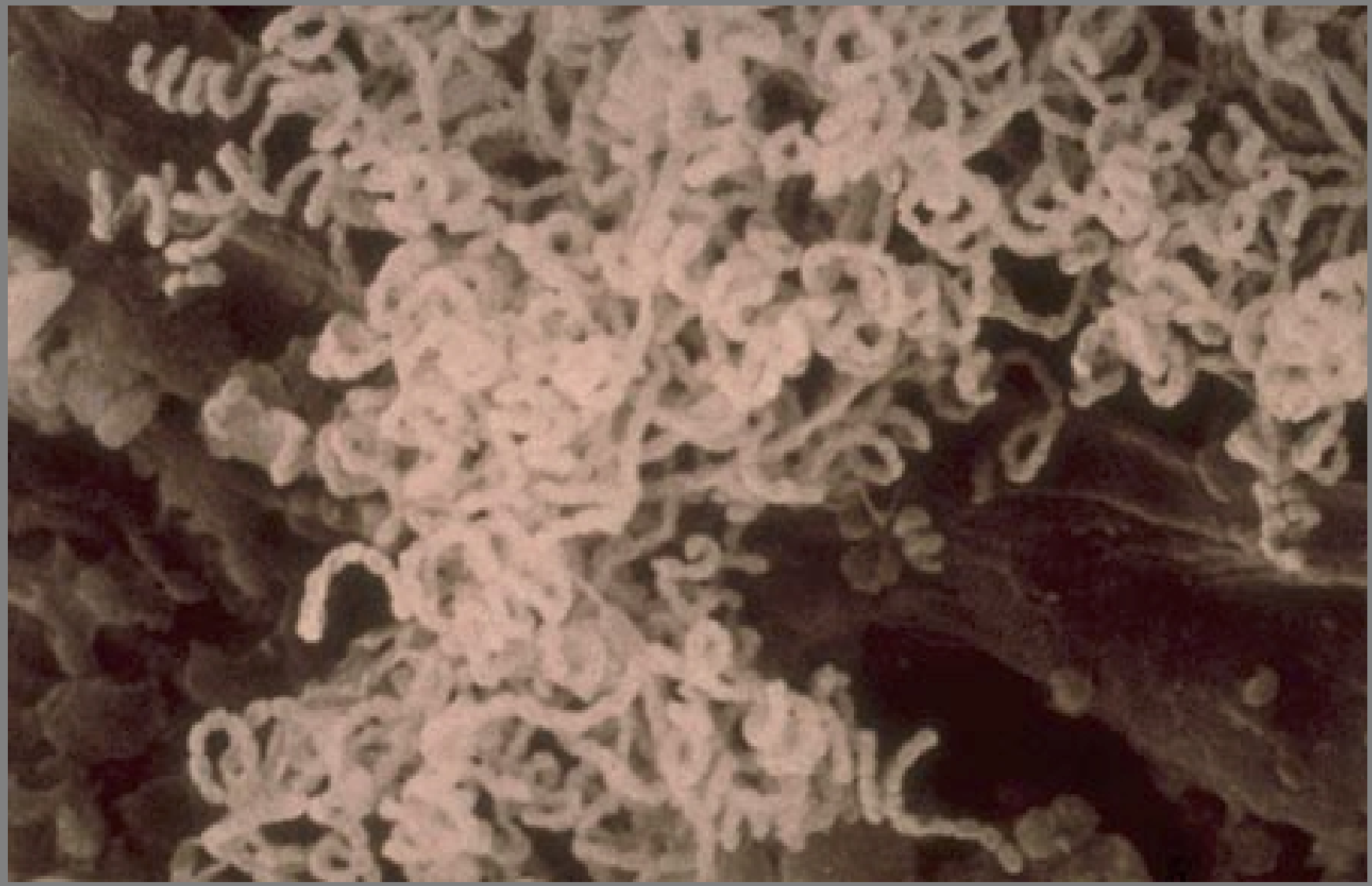
Liquid - Water

Soil Properties

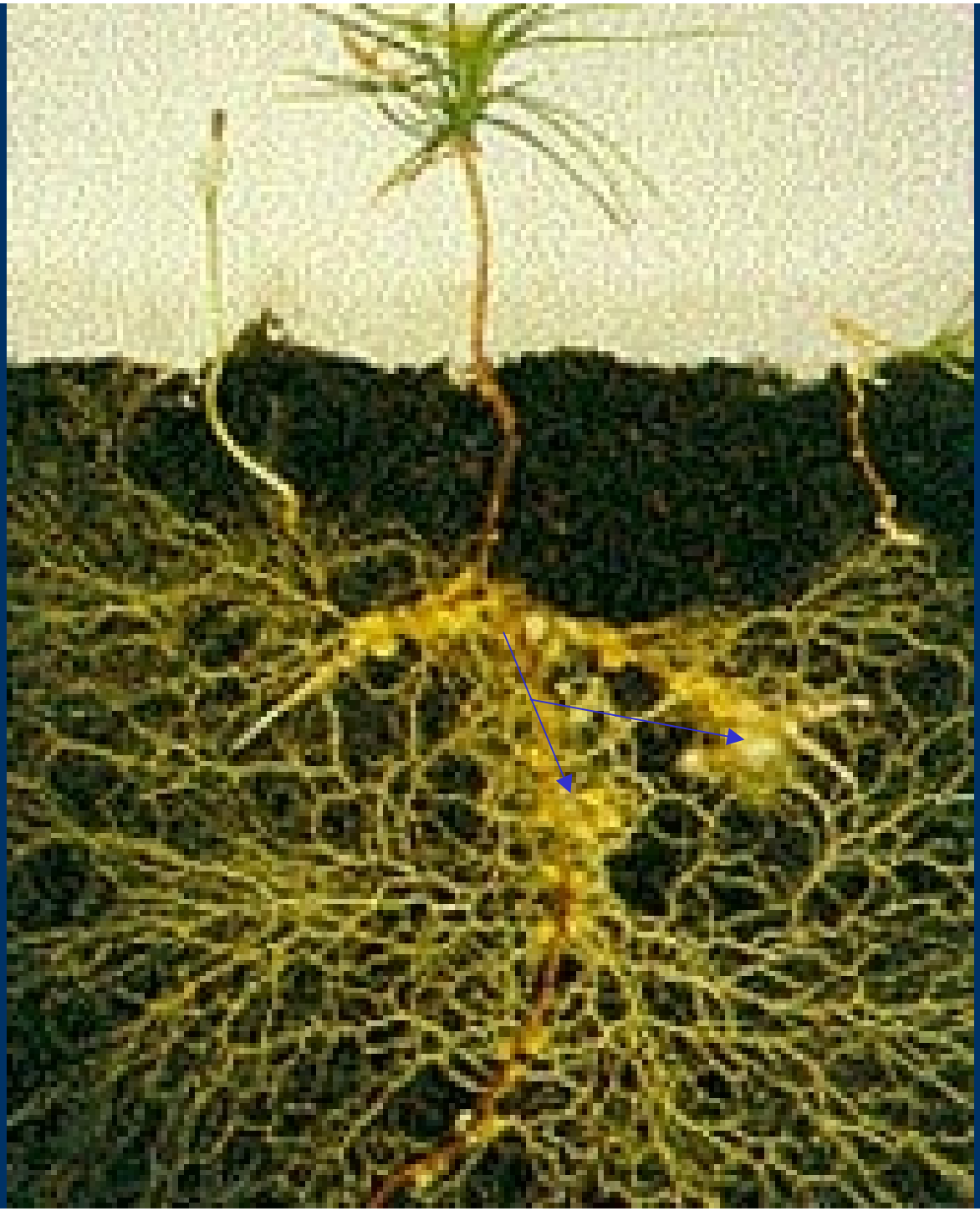
- ***Organic Matter***
- Minerals
- Air
- Water


Rangeland Soil Food Web
Nematodes
Arthropods
Birds
Man
Animals
Plants
Fungi
Nematodes
Higher predators
Bacteria
Protozoa
Animals
Organic matter
Human consumption
Grazing
Photosynthesis
Decomposition
Mineralization
Symbiotic association
Root feeding
Predation
Grazing
Predation

Actinomycetes bacteria

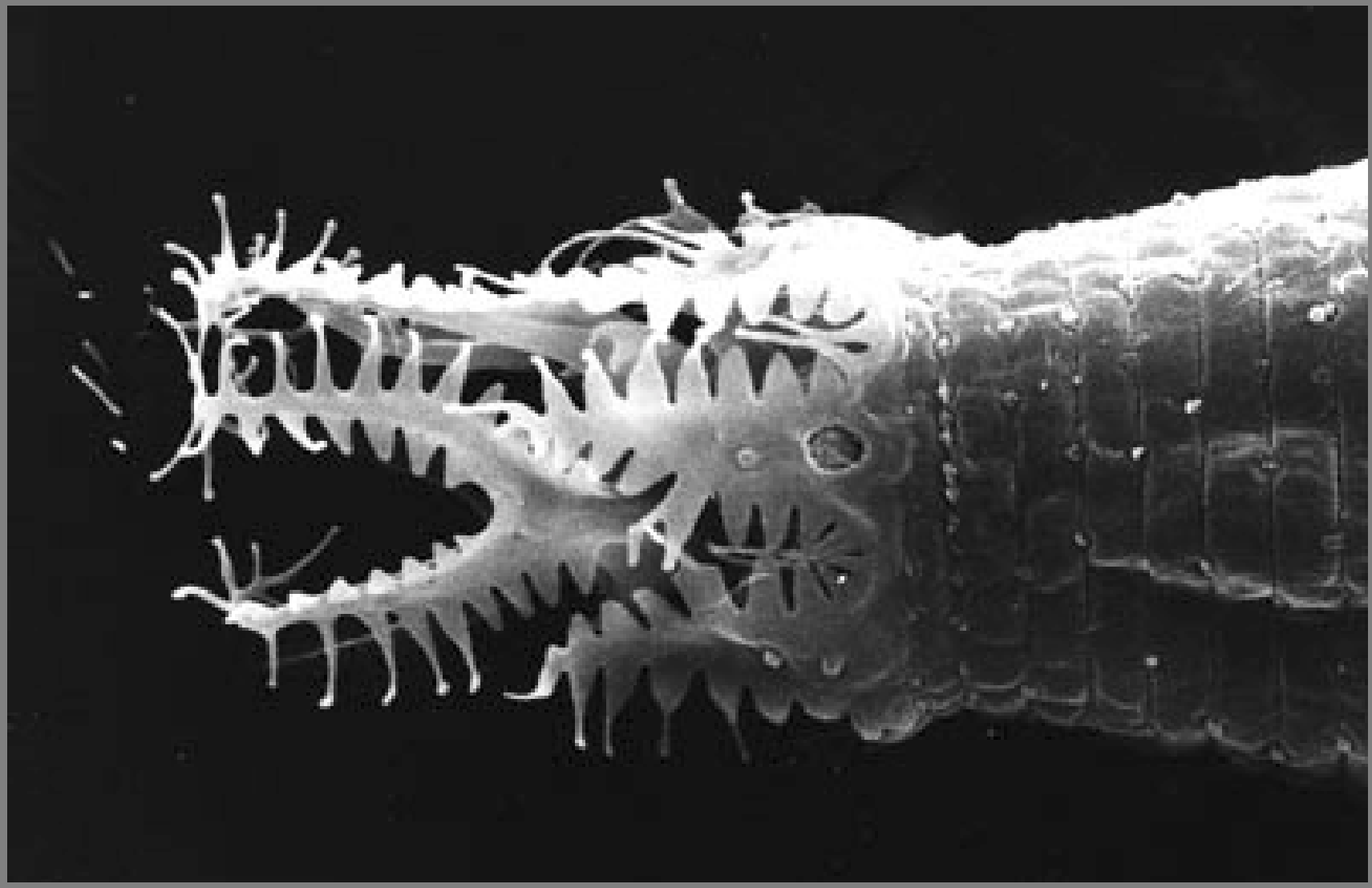


Fungi

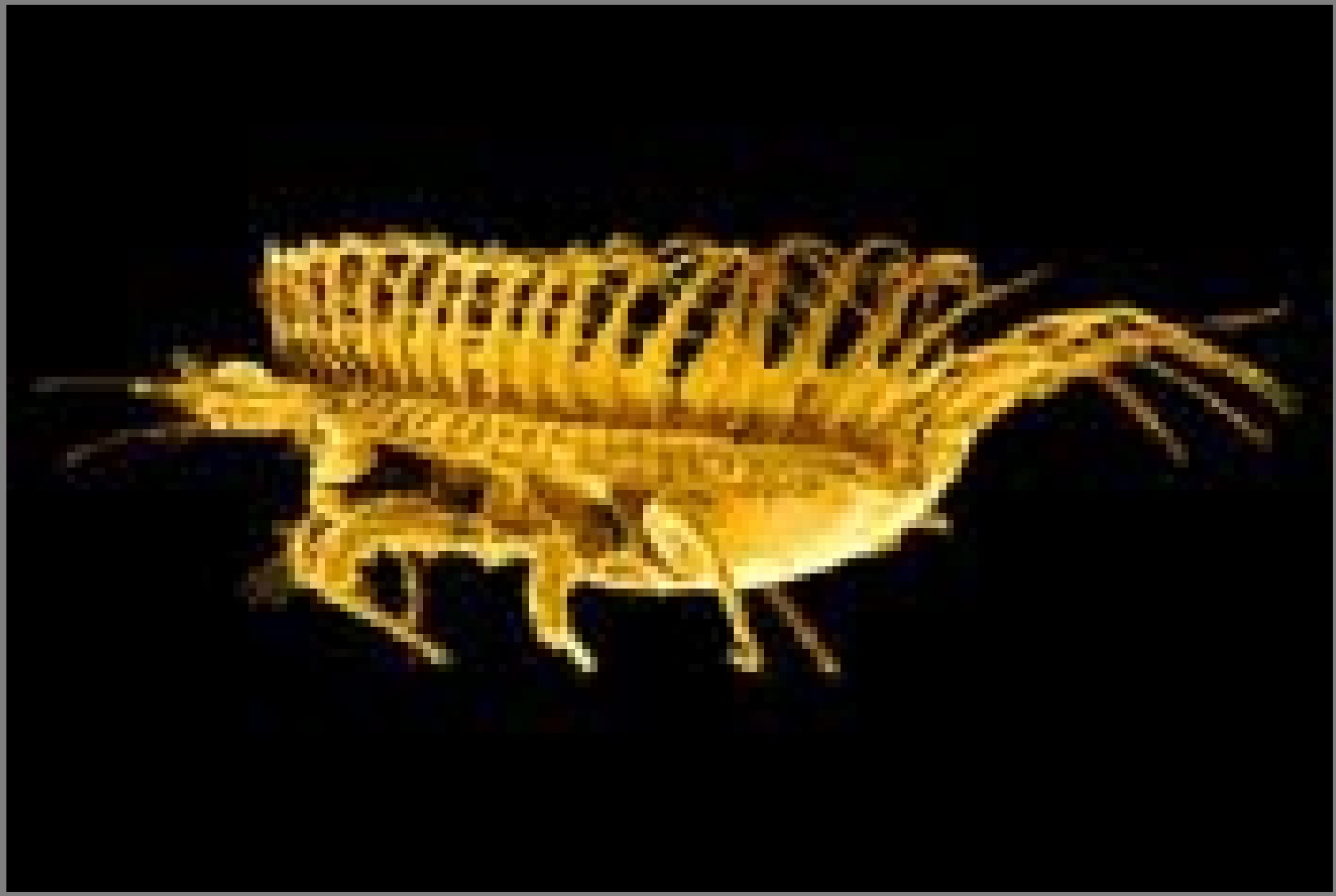


Protozoa

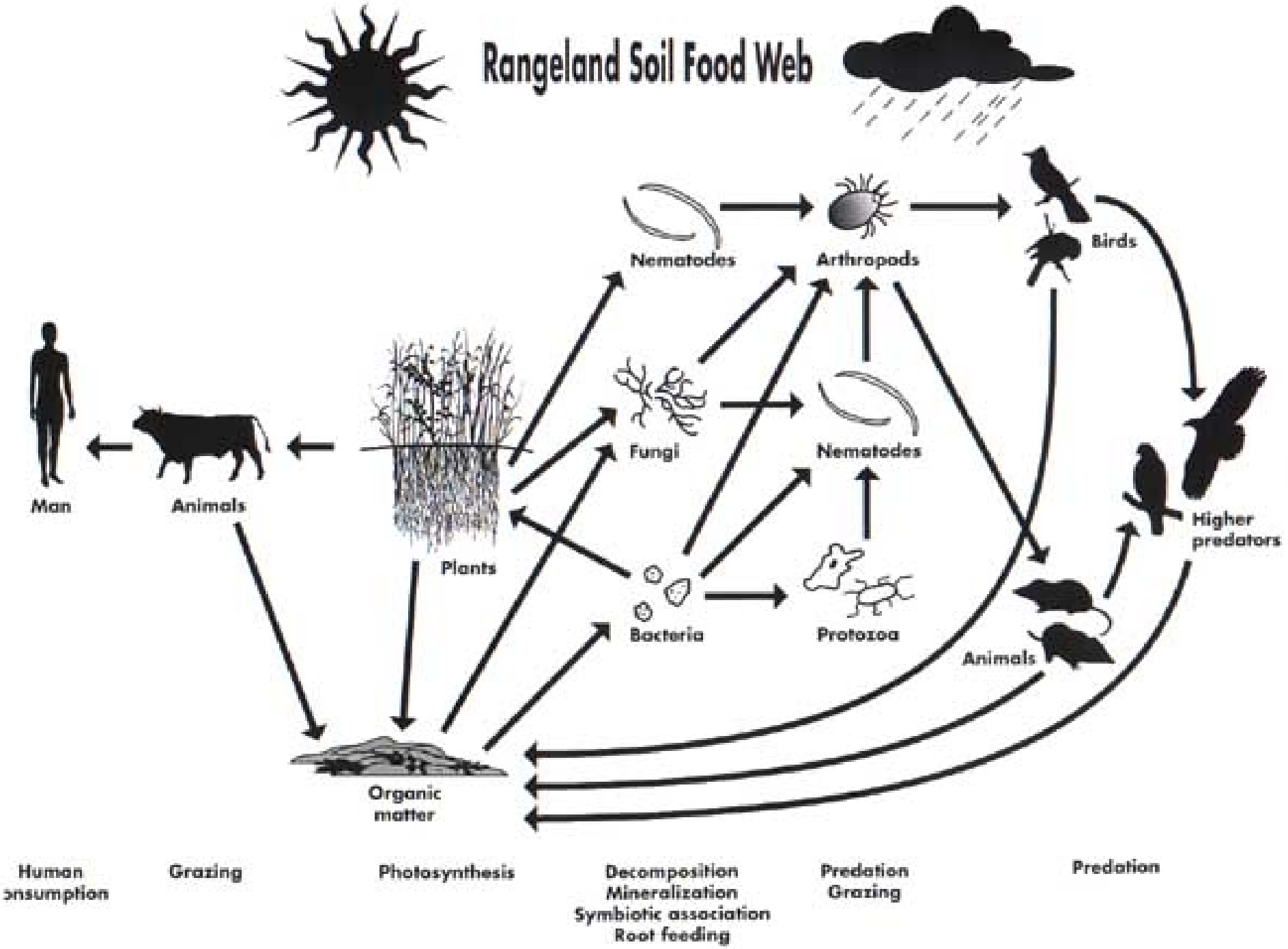
Nematode - Acrobeles head



Arthropod - Basket mite




Townsend’s ground squirrel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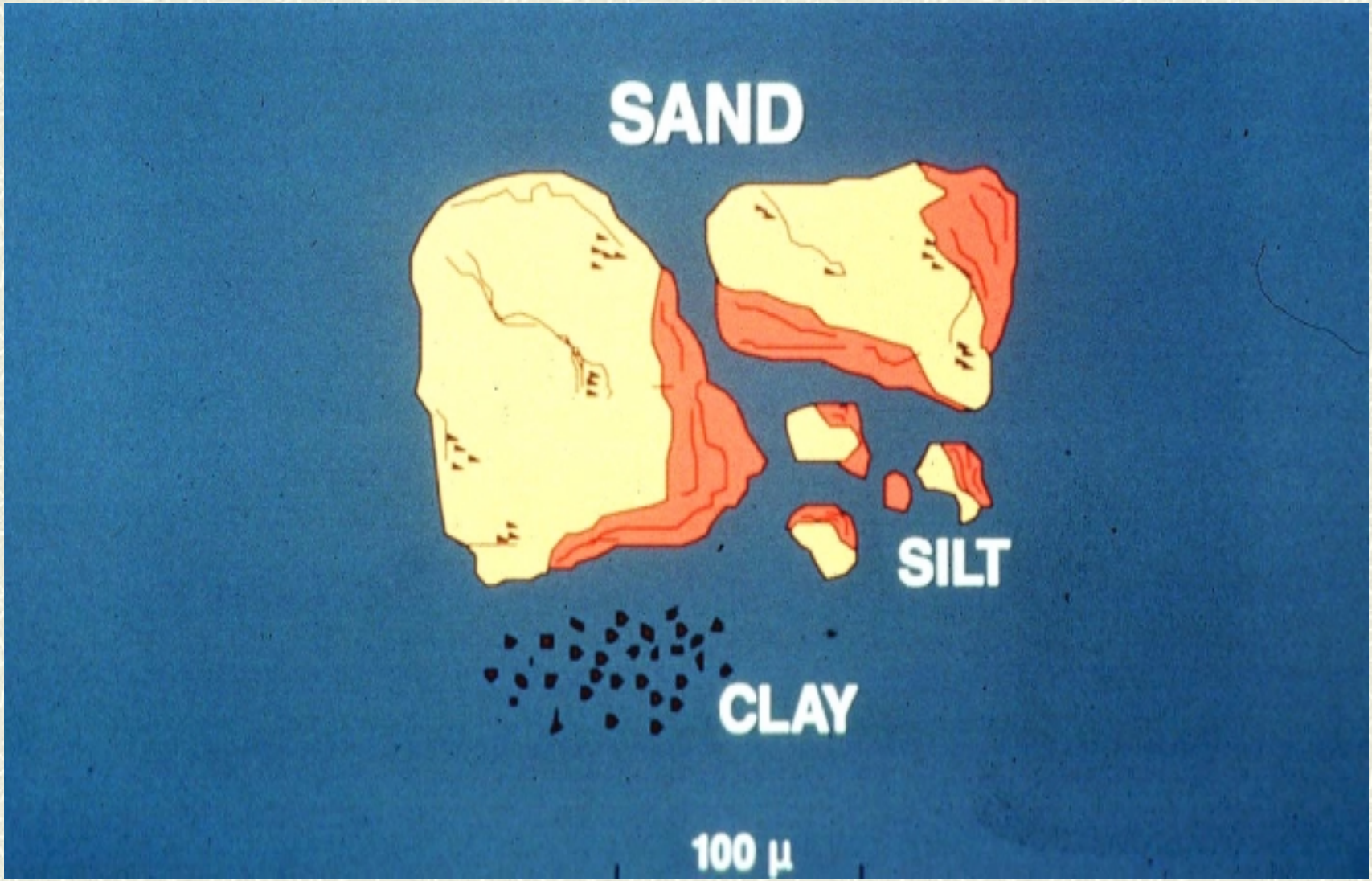
Symbiotic association
Root feeding
Predation
Grazing
Predation

Soil Properties

- Organic Matter
- ***Minerals***
- Air
- Water

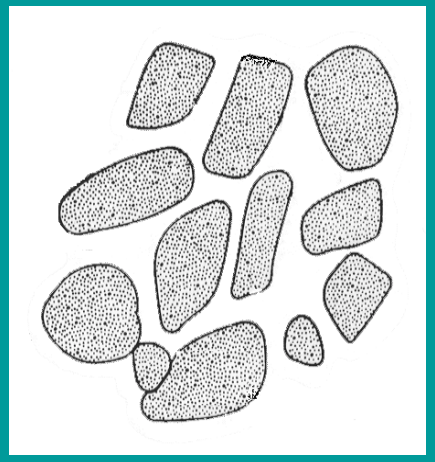

Basalt

Soil Particle Size and Texture



Influence of Texture

Surface area of soil particles



Clay and Silt

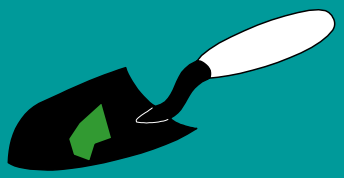
Fine Textured

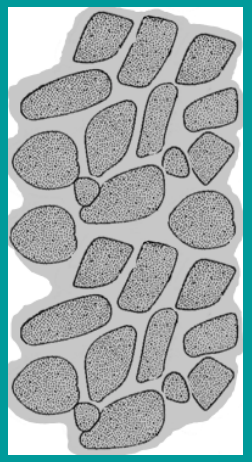
Thousands to millions of sq. in. in one ounce of soil

Sand

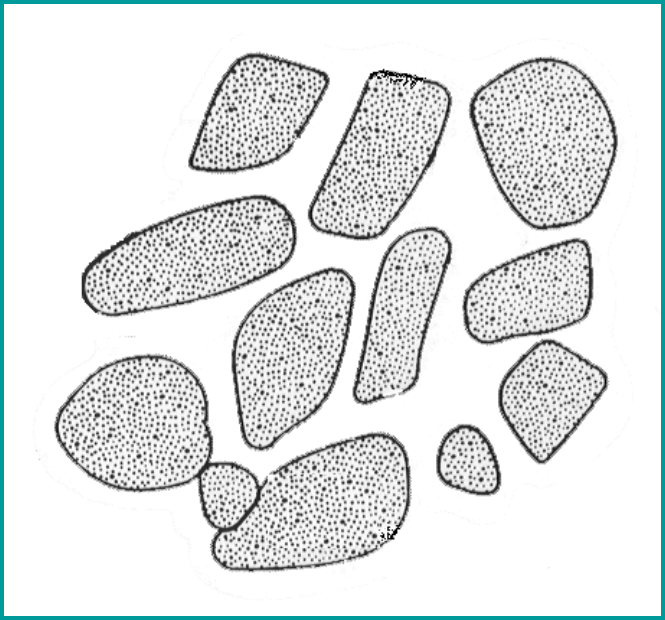
Coarse Textured

50 sq. in. per ounce of soil





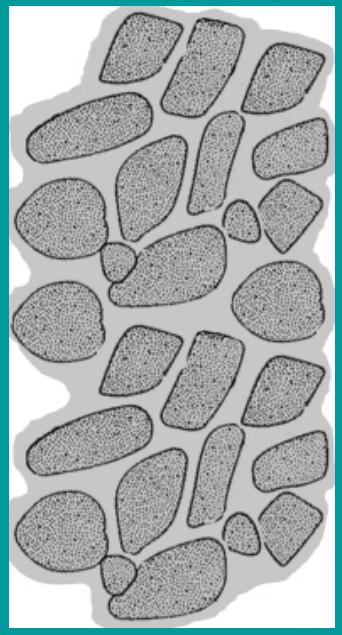
Influence of Texture



Sand

- Coarse textured
- Less total pore space
- Greater proportion of large pores
- Water moves easily through soil
- Holds less water

Influence of Texture



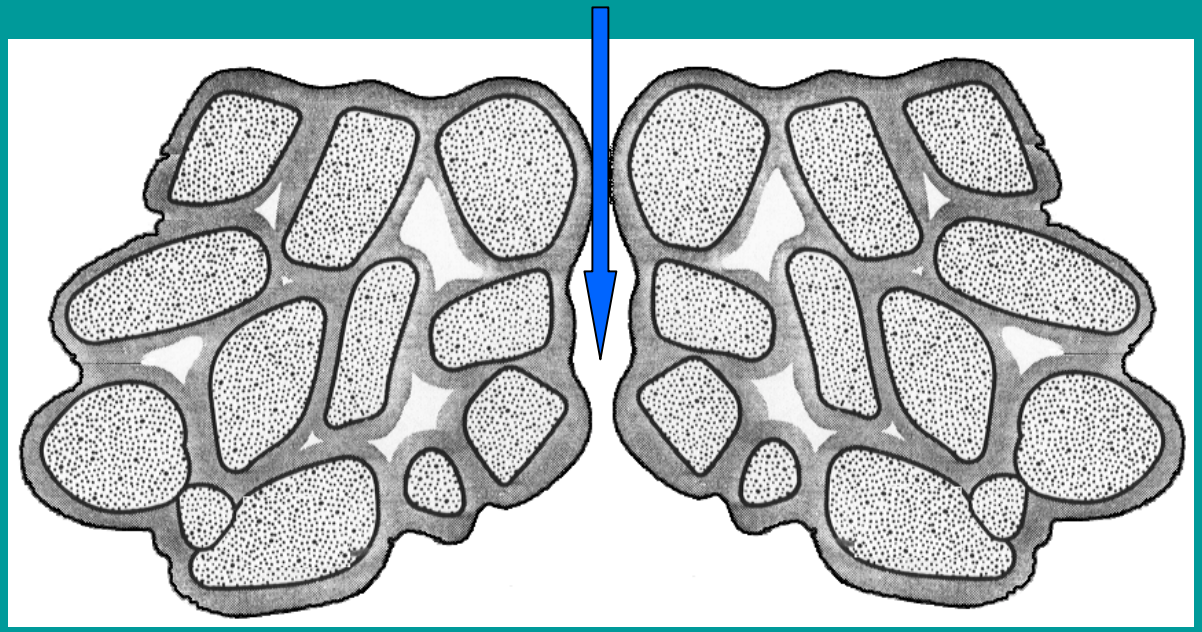
Silt and Clay

- Fine Textured
- More total pore space
- Greater proportion of small pores
- Holds more water
- Water moves with difficulty

Soil Structure

Sand held together with clay minerals

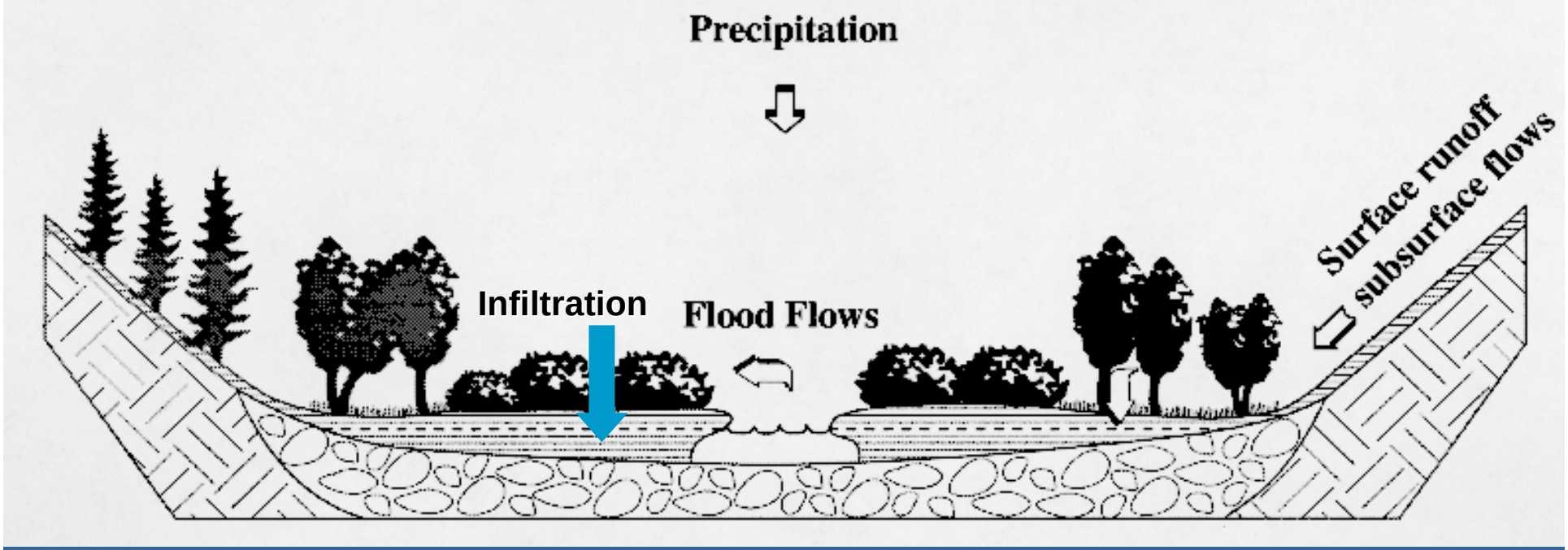
Structure - Aggregation of Soil Particles into Peds



Spaces between peds facilitate the movement of air, water, and roots

Soil Properties

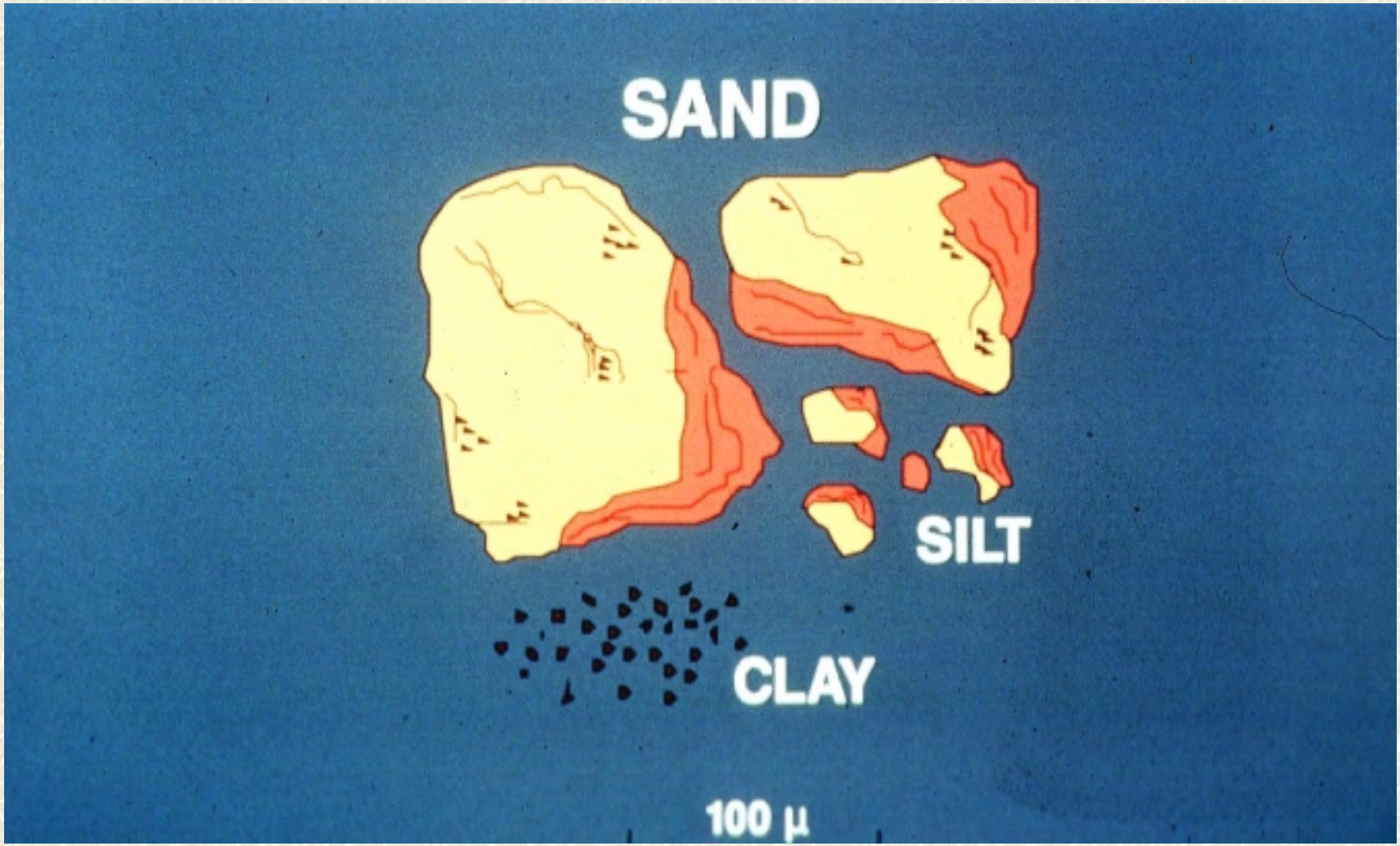
- Organic Matter
- Minerals
- ***Air***
- ***Water***



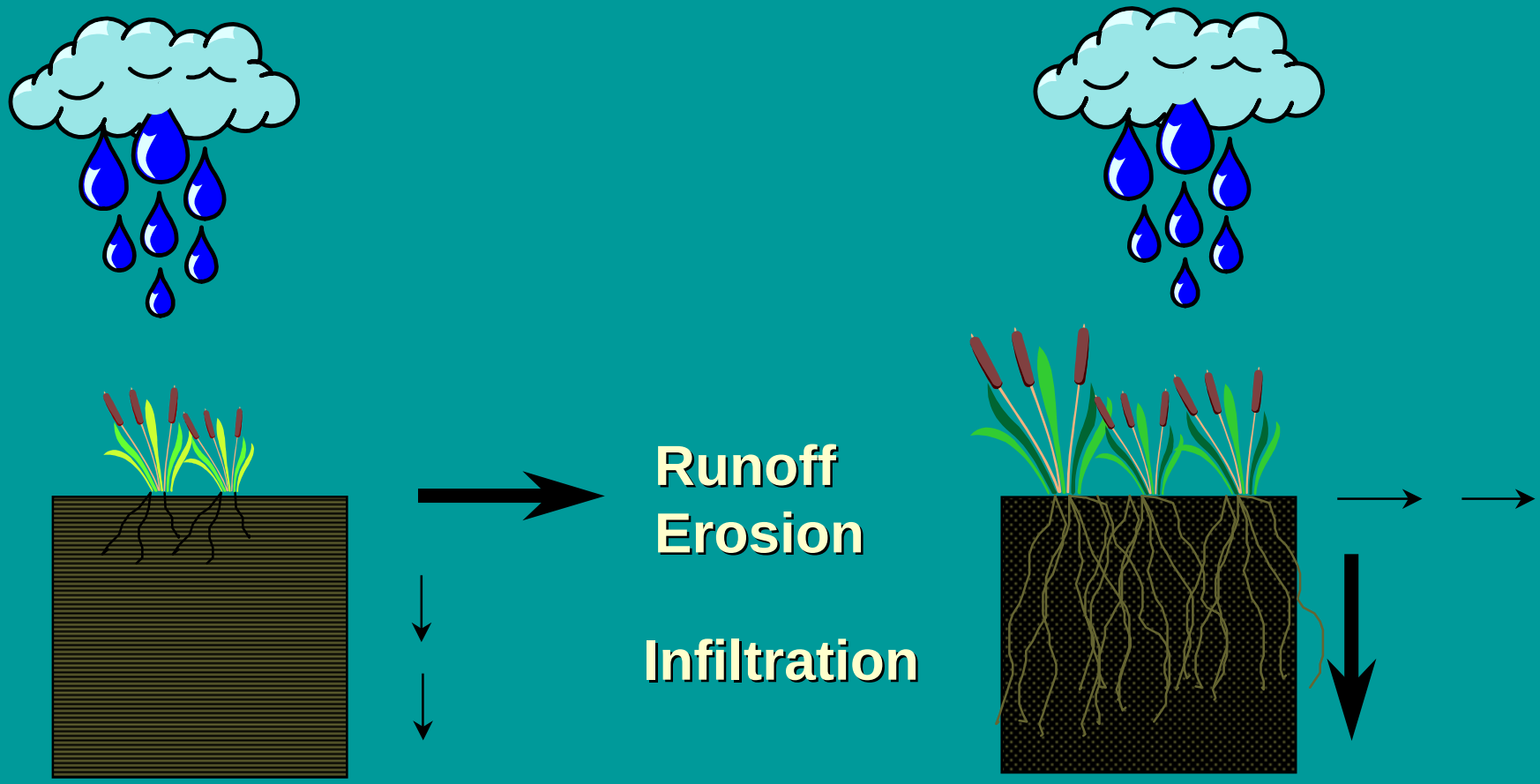
- If enough water infiltrates, the soil will become saturated
- Soil moisture then reaches the water table and recharges ground water
- Infiltration of water into soil will gradually release into streams
- High infiltration rates reduce threat from small to moderate floods


Alaska peat bog
Peat

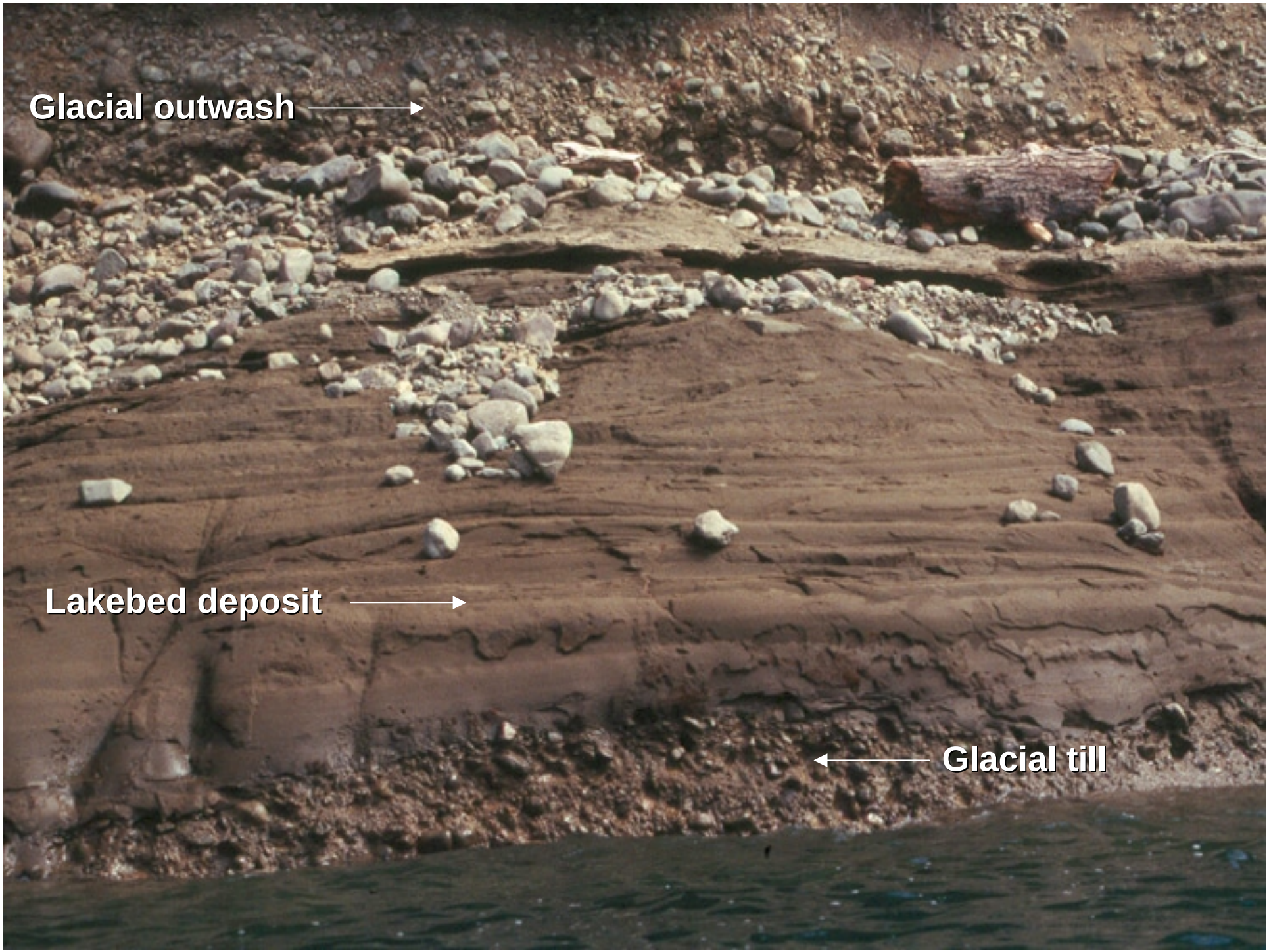
Soil Particle Size



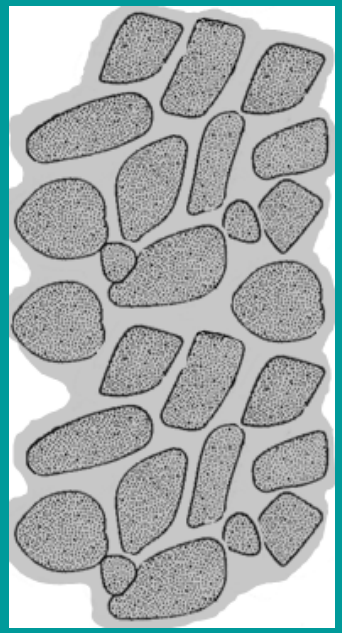
Effects of Compaction




Idaho floodplain


Glacial outwash
Lakebed deposit
Glacial till

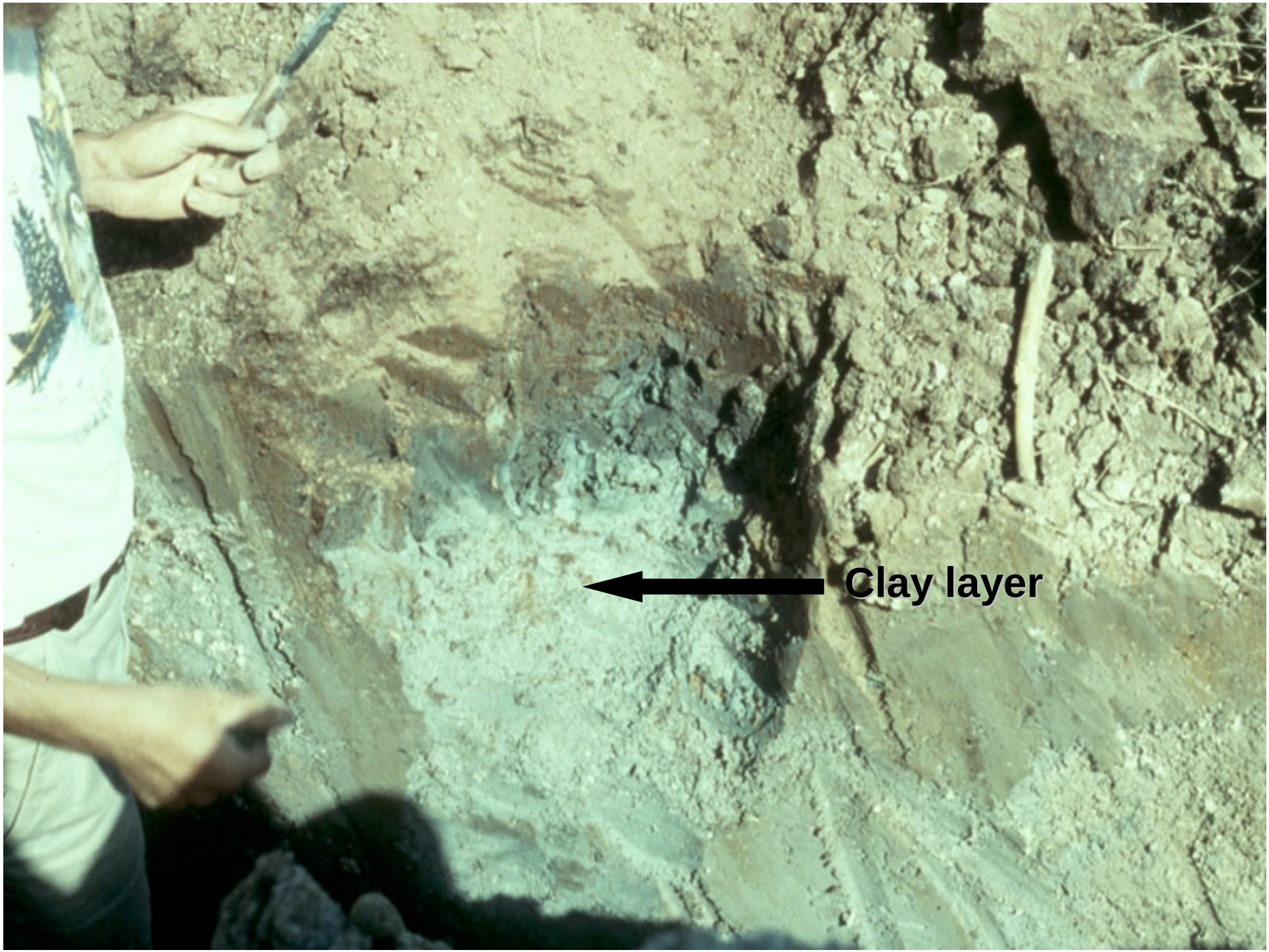
Influence of Texture and Structure



Silt and Clay

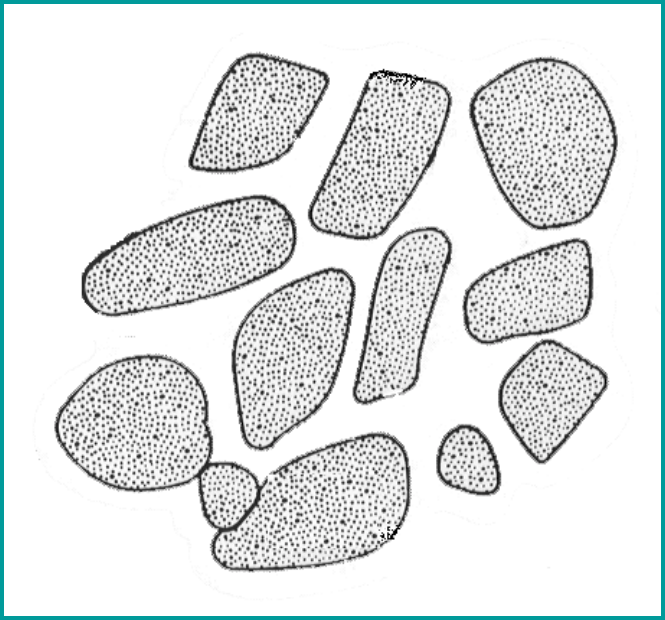
- **Fine Textured**
- **More total pore space**
- **Greater proportion of small pores with**
- **Holds more water**
- **Water moves with difficulty**
- **High capillary tension**


Capillary action

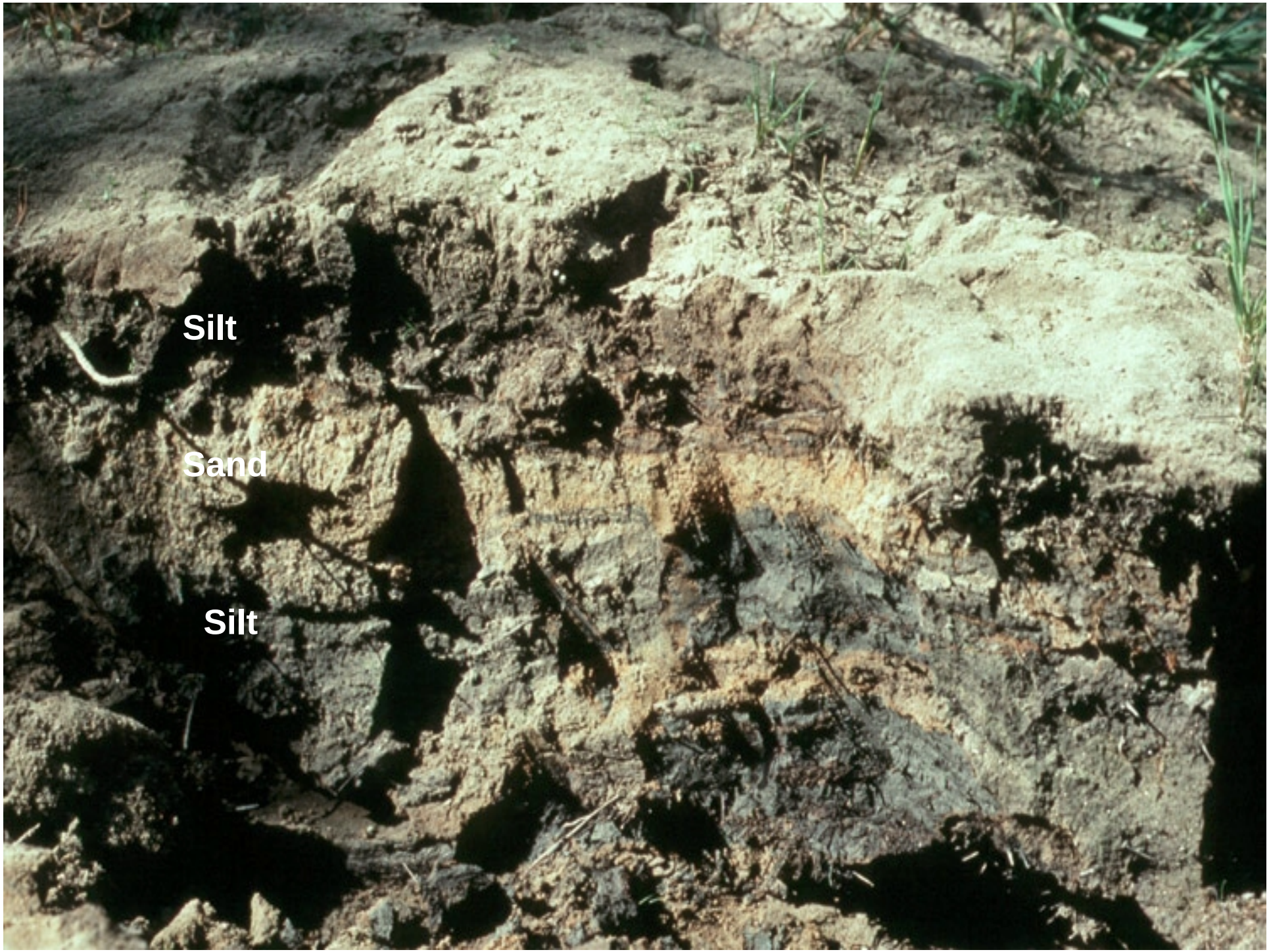

Clay layer

Influence of Texture and Structure

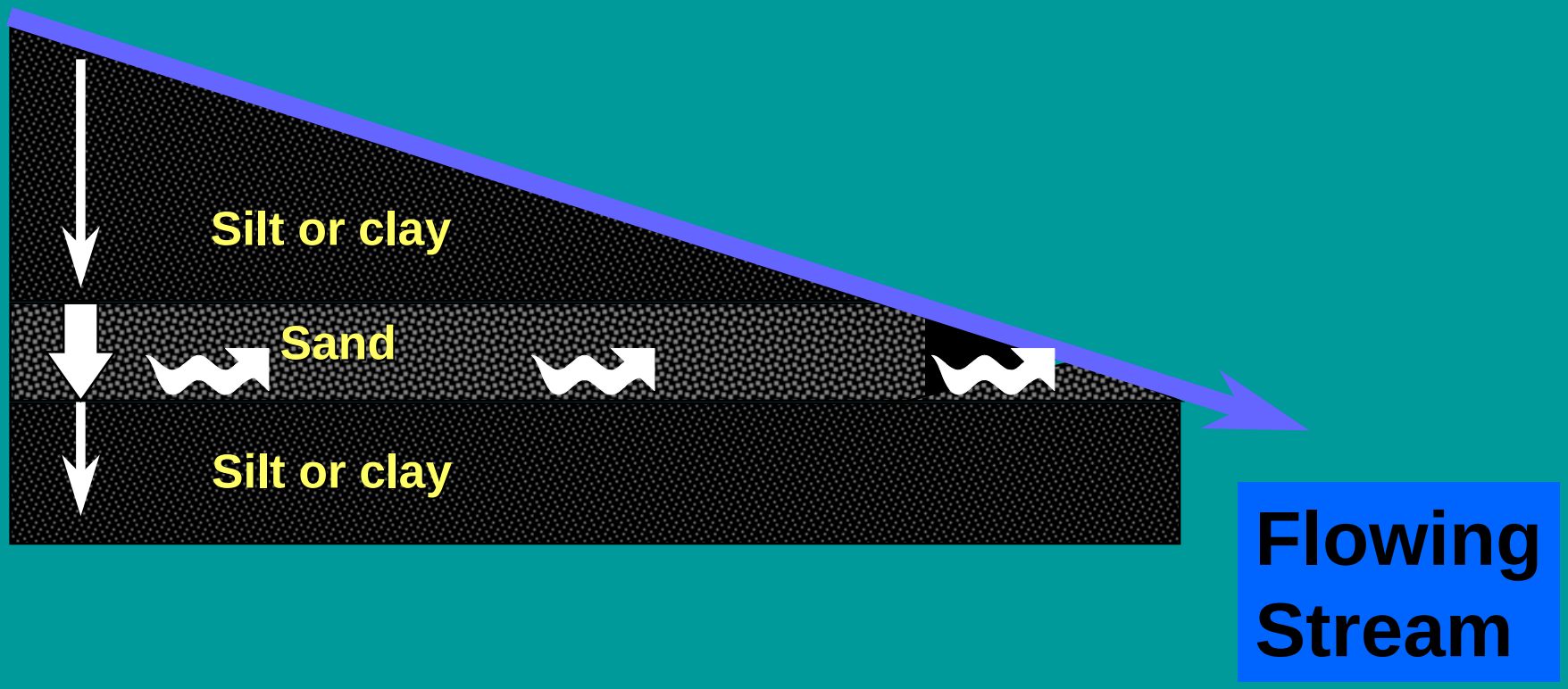
Sand



- Coarse textured
- Less total pore space
- Greater proportion of large pores
- Low capillary tension
- Water moves easily through soil
- Holds less water


Silt
Sand
Silt

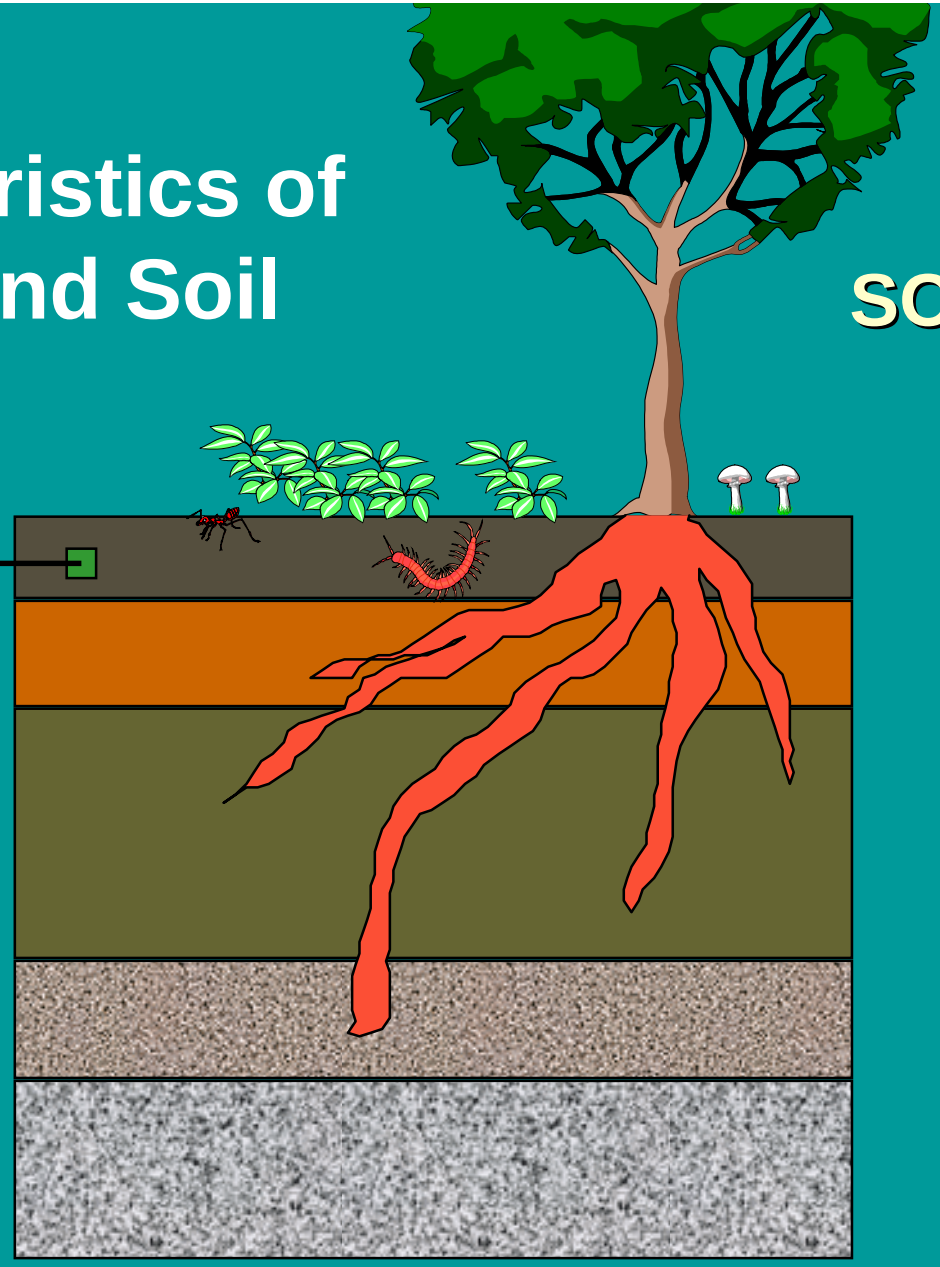
Water Movement in Stratified Soils



Riparian Soil

Upland Soil

Characteristics of an Upland Soil



1 ounce ~ 1 billion bacteria - organic matter

SOIL HORIZONS

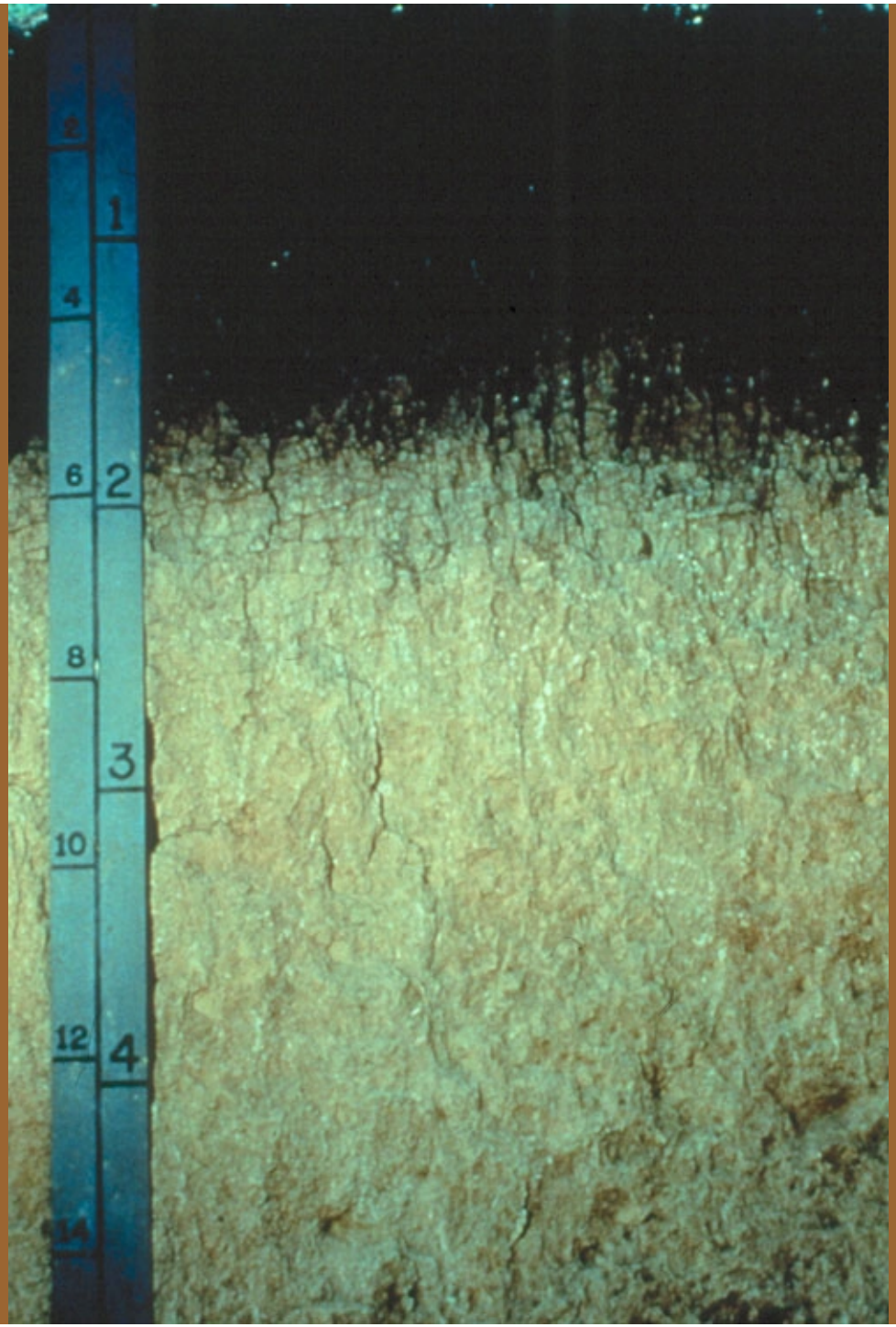
- Organic Layer
- Topsoil
- Subsoil
- Parent Material
- Bedrock

A Living, Dynamic System

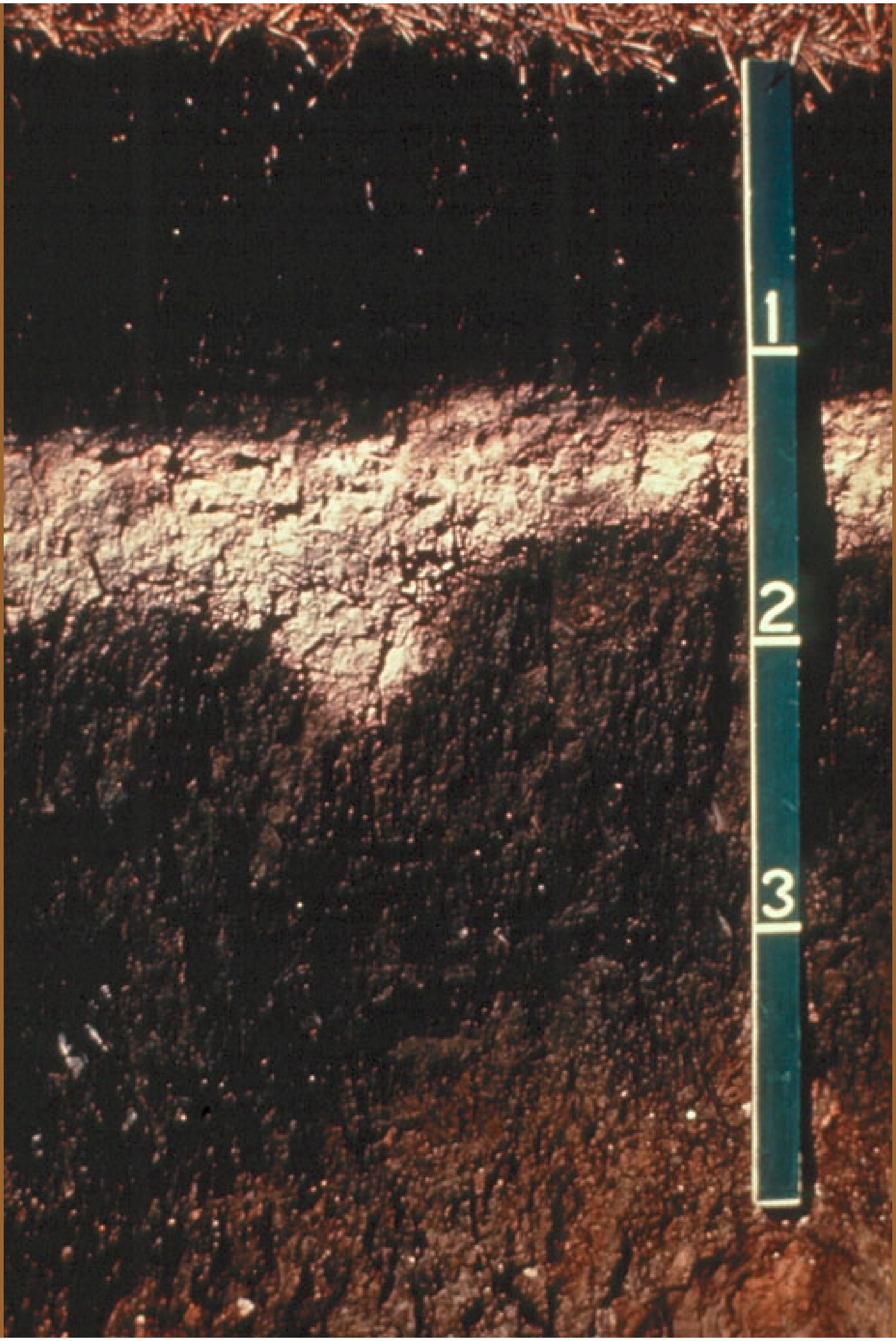
Wyoming

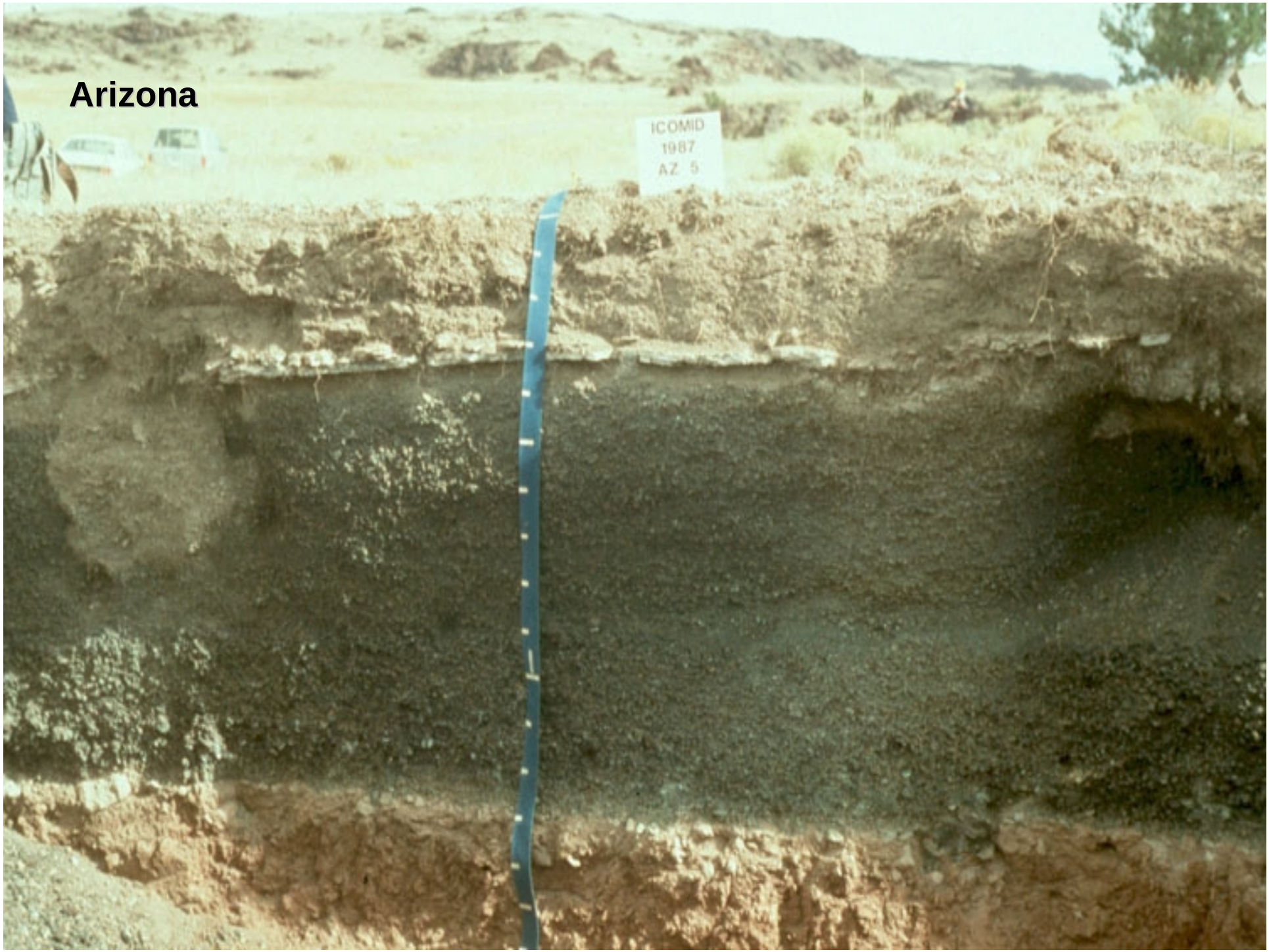
Mt. St. Helens

Kansas



North Dakota




Arizona
ICOMID
1987
AZ 5

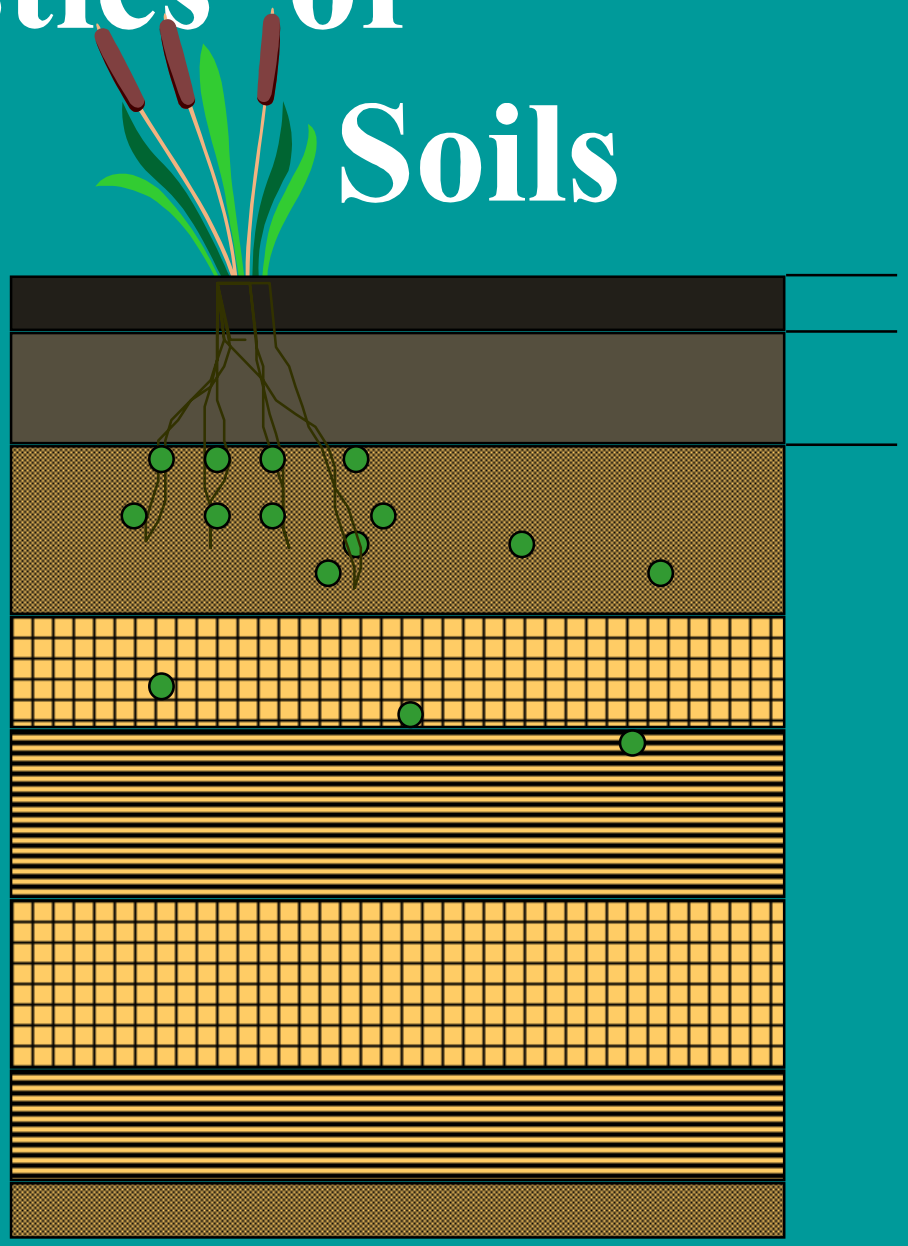

Upland
Riparian

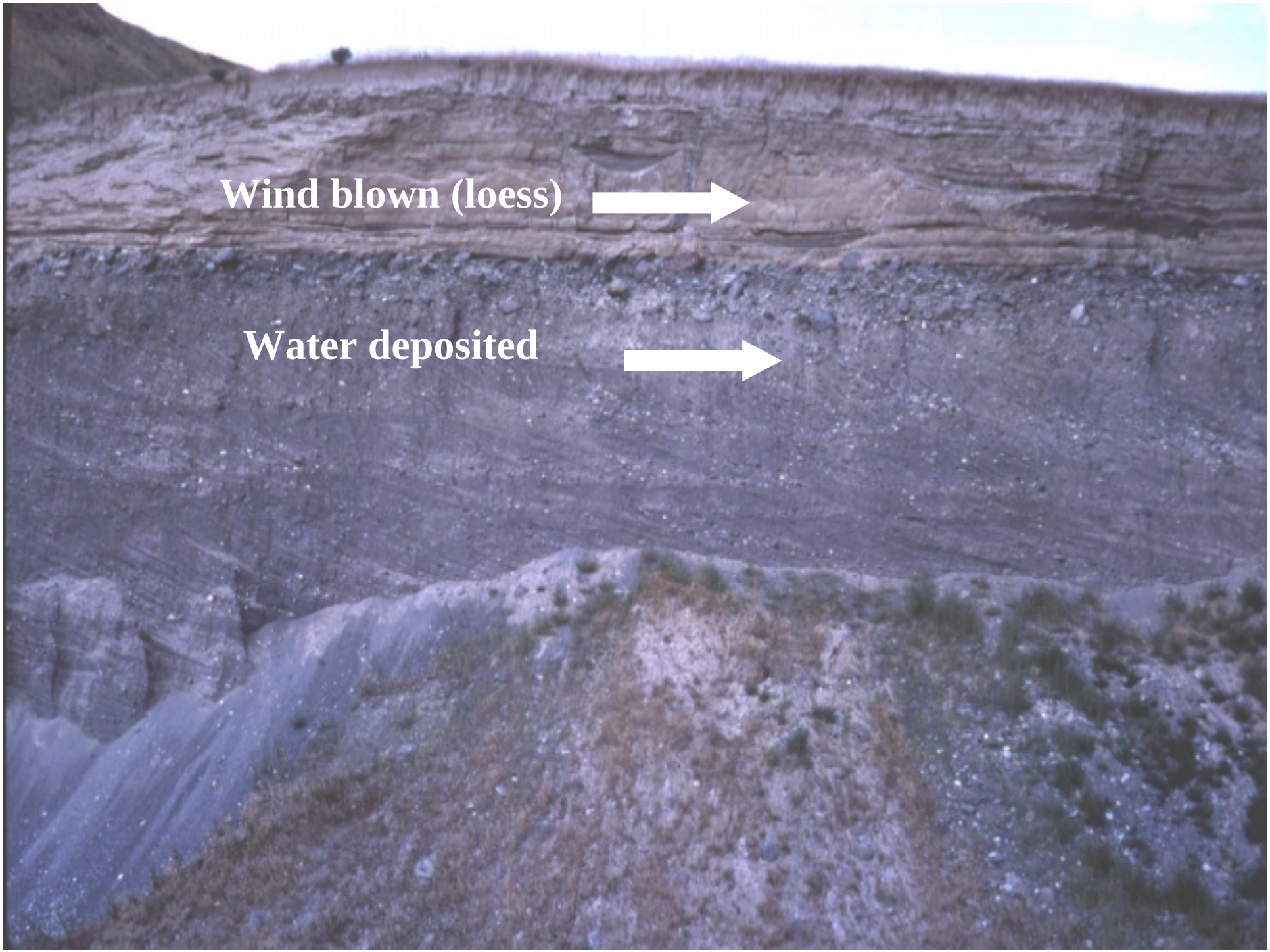
Characteristics of Riparian Soils

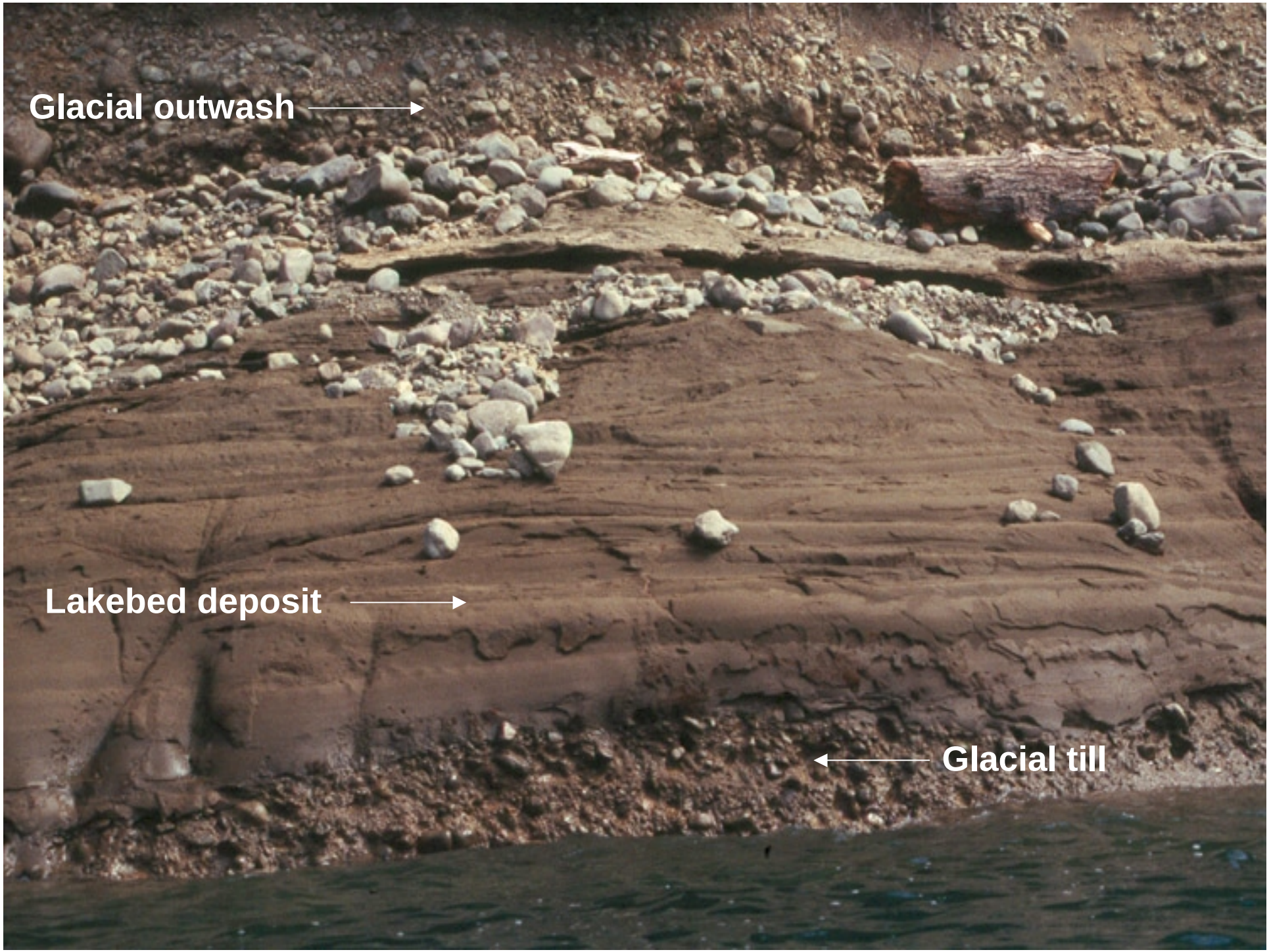
O Organic Debris

A Organic matter Incorporated into surface layer

C Recently Deposited sediments




Wind blown (loess)
Water deposited


Glacial outwash
Lakebed deposit
Glacial till

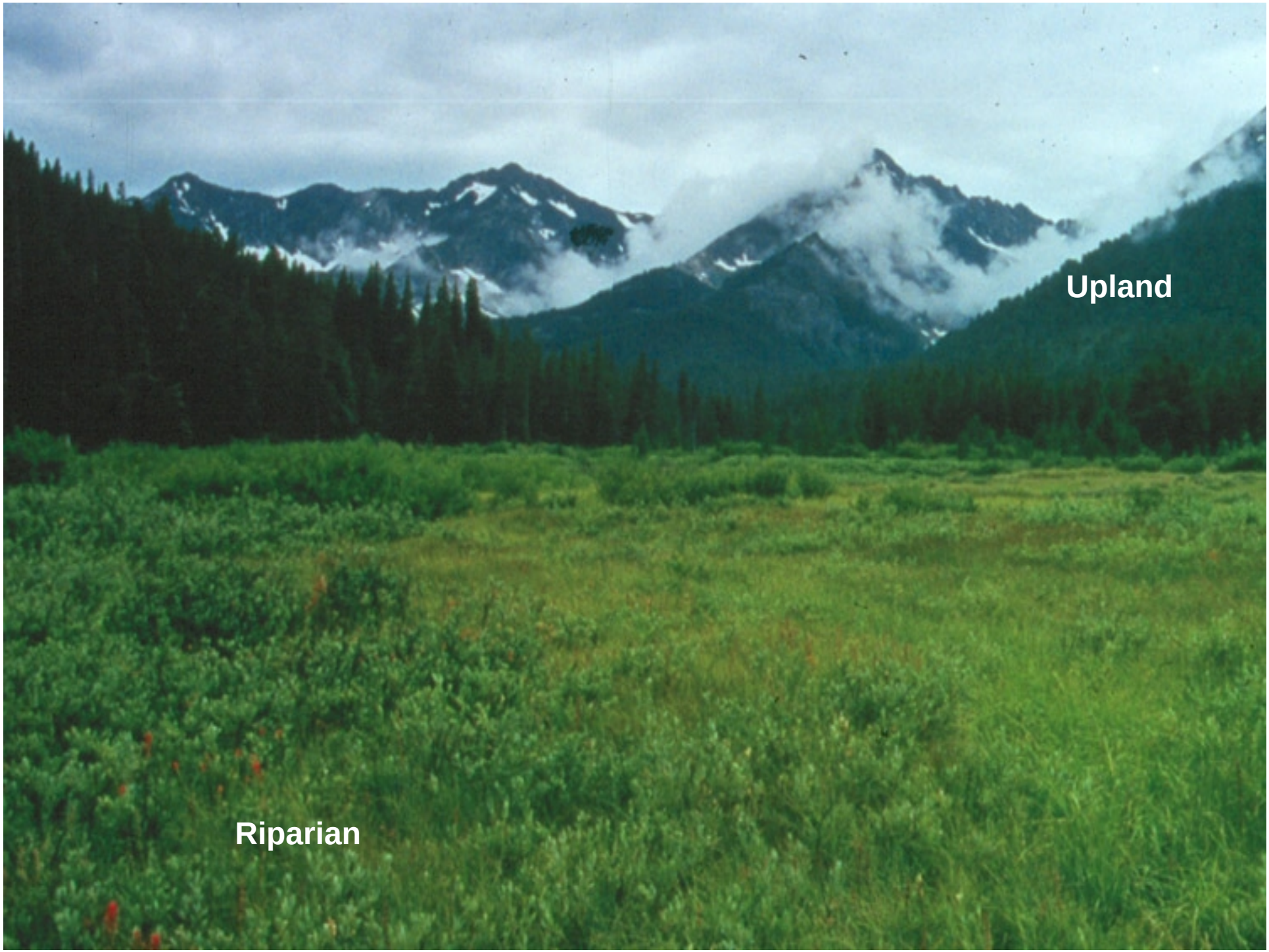

One year old debris torrent -
Central Oregon
Deposition terrace


Skokomish River
Washington State

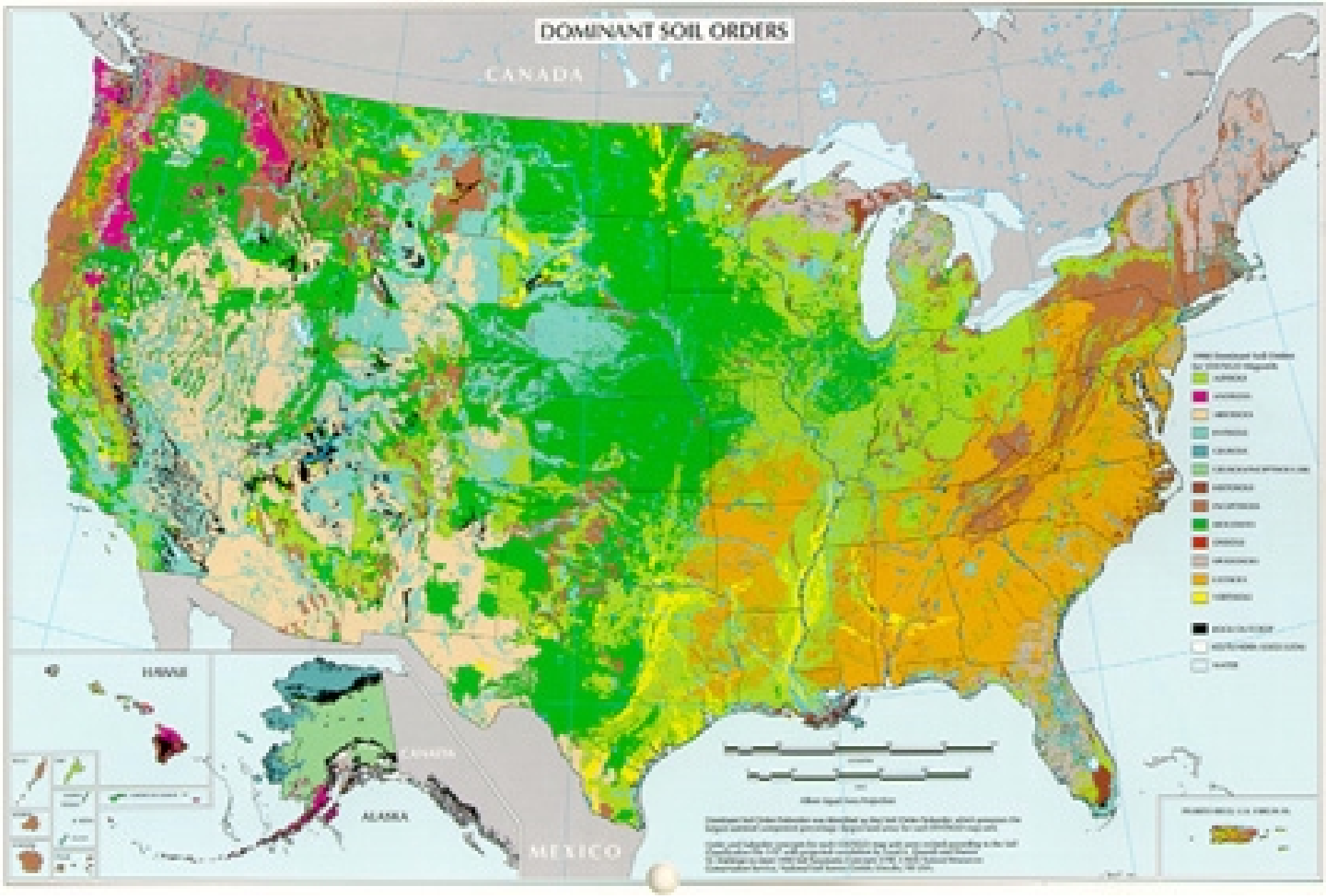

Debris torrent


Central Oregon


Montana meadow

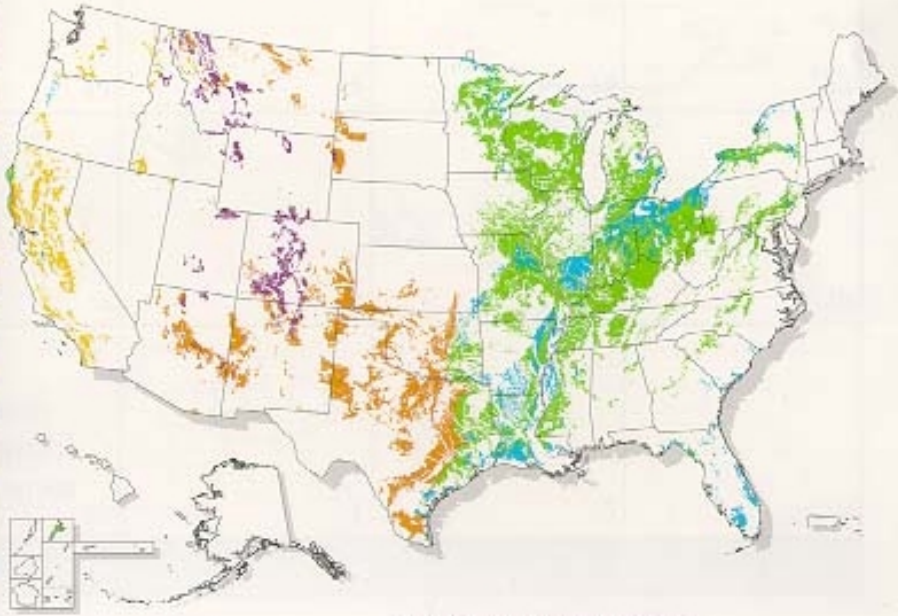

Upland
Riparian

Twelve Soil Orders – Soil Taxonomy



ALFISOLS

Alfisols - Soils in semiarid to humid areas that have a clay and nutrient-enriched subsoil. They commonly have a mixed vegetative cover and are productive for most crops.



ARIDISOLS

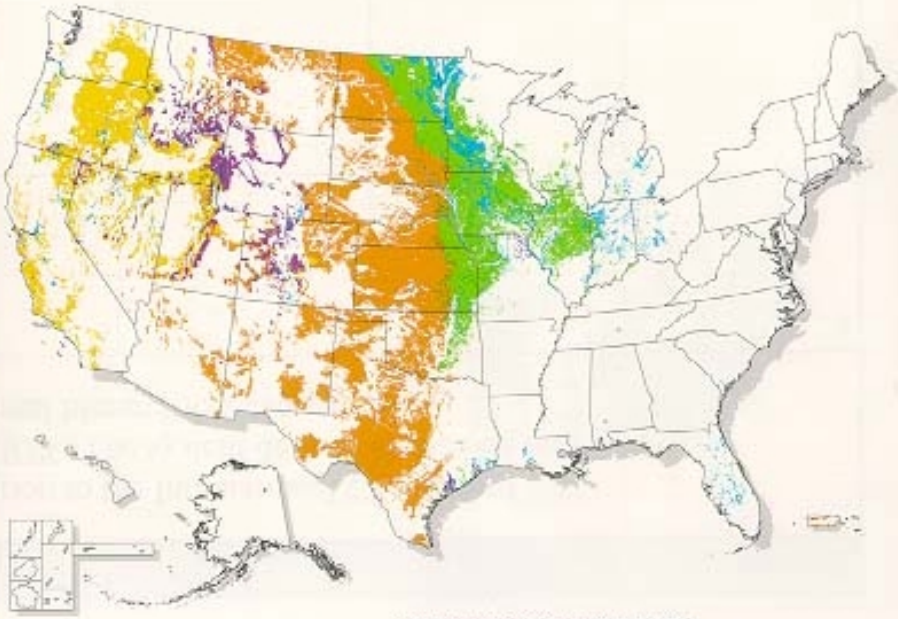
Aridisols - Soils that are too dry to grow mesophytic plants. They may have a clay-enriched subsoil and/or cemented to noncemented deposits of salts or carbonates. These soils are commonly in the deserts of Western states.

DOMINANT SUBORDERS

- Argids
- Calcids
- Cambids
- Cryids
- Durids
- Gypsids
- Salids

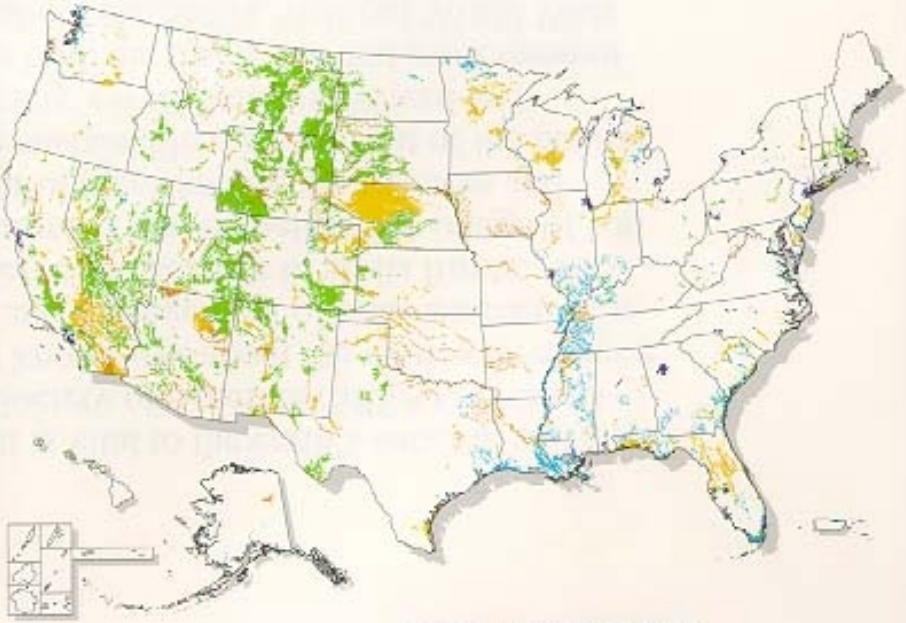
MOLLISOLS

Mollisols - Soils that have a dark surface horizon. These soils formed from nutrient-rich parent material, and are commonly in grasslands. They are dominantly in the Great Plains and Western States.

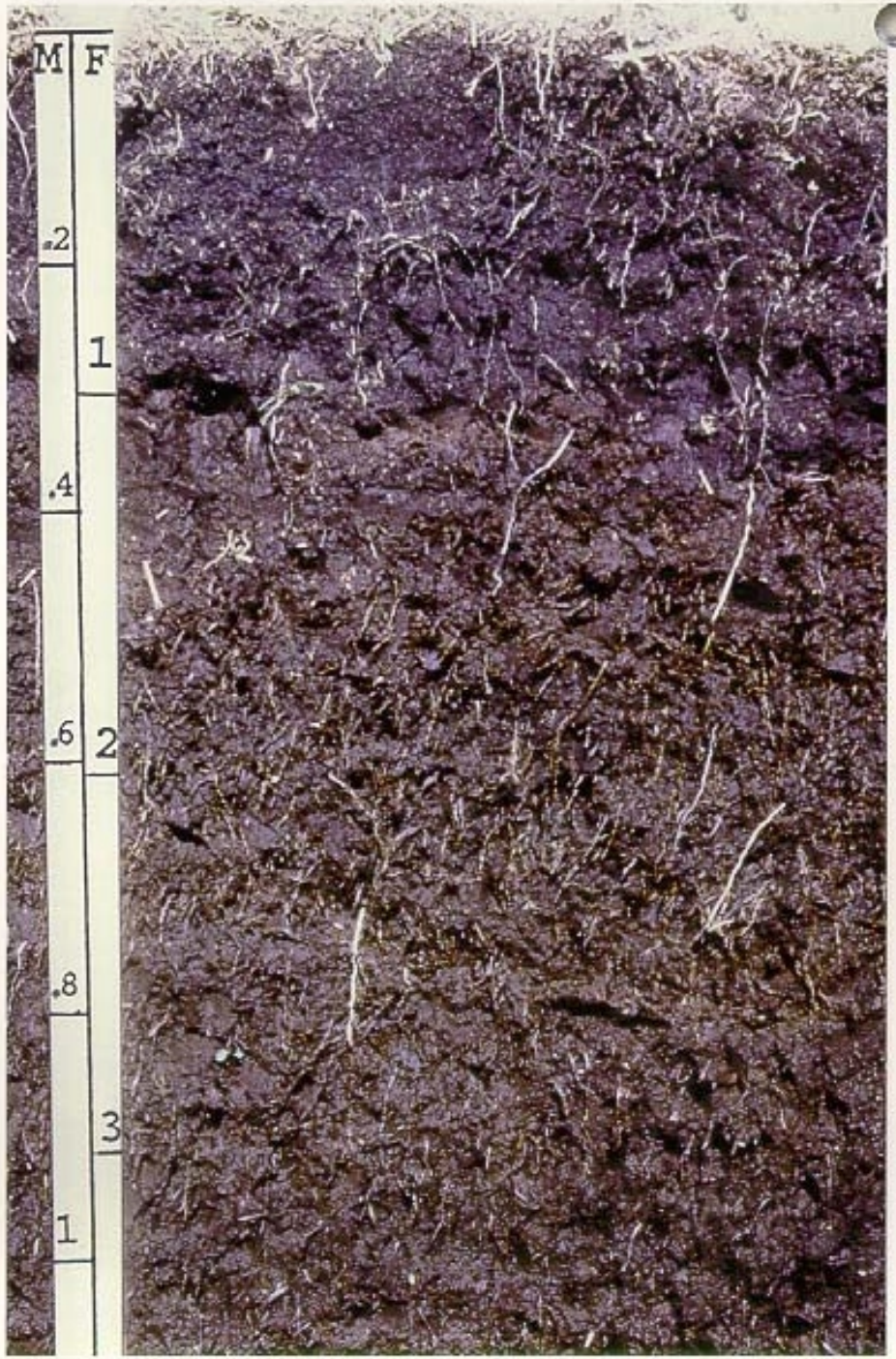


ENTISOLS

Entisols - Soils that have little or slight development and properties that reflect their parent material. They include soils on steep slopes, flood plains, and sand dunes. They occur in many environments.



HISTOSOLS

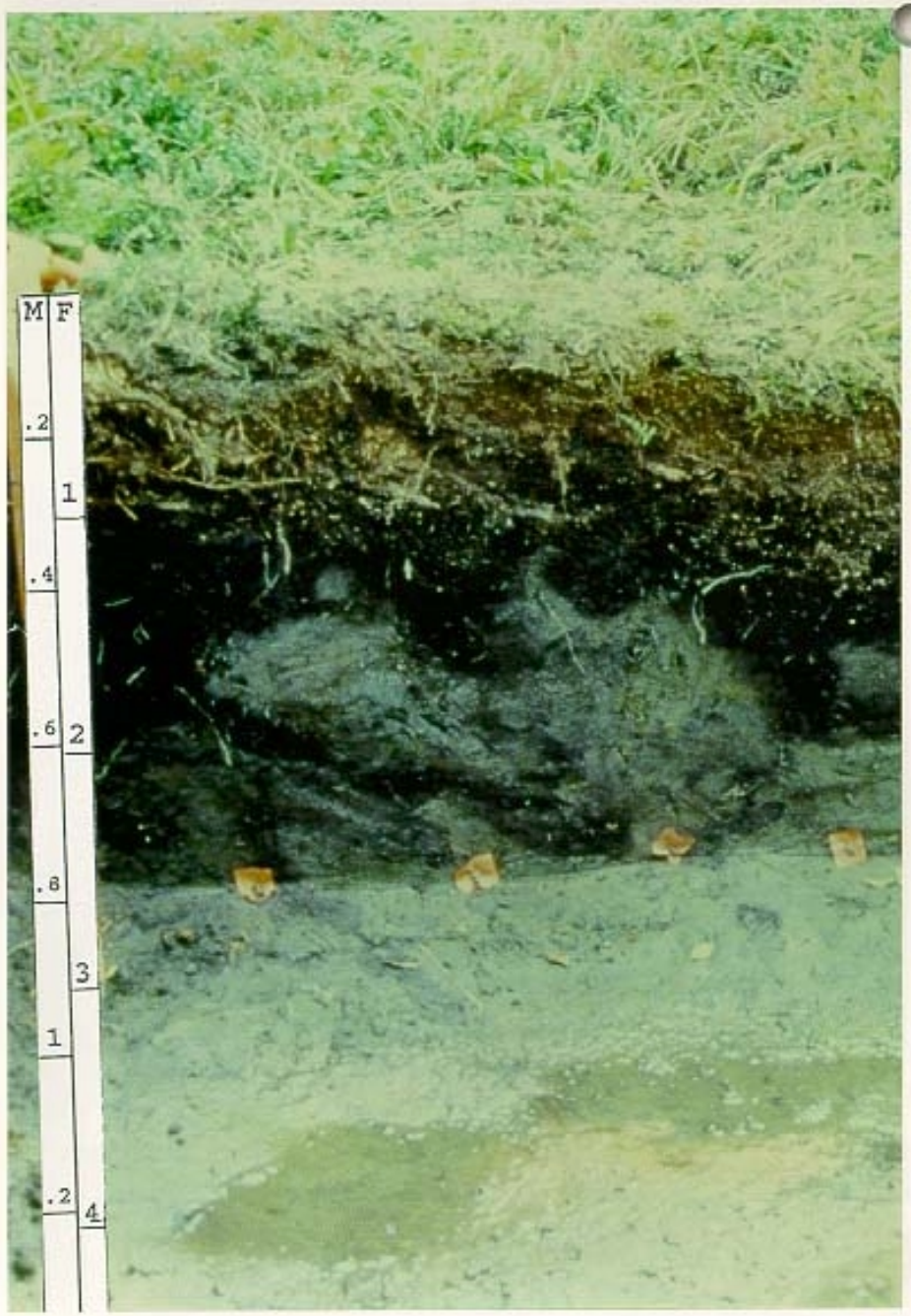


Histosols - Dark soils that have slightly decomposed to well decomposed organic materials derived from sedges, grasses, leaves, hydrophytic plants and woody materials. These soils dominantly are very poorly drained and occur in low-lying areas.

DOMINANT SUBORDERS

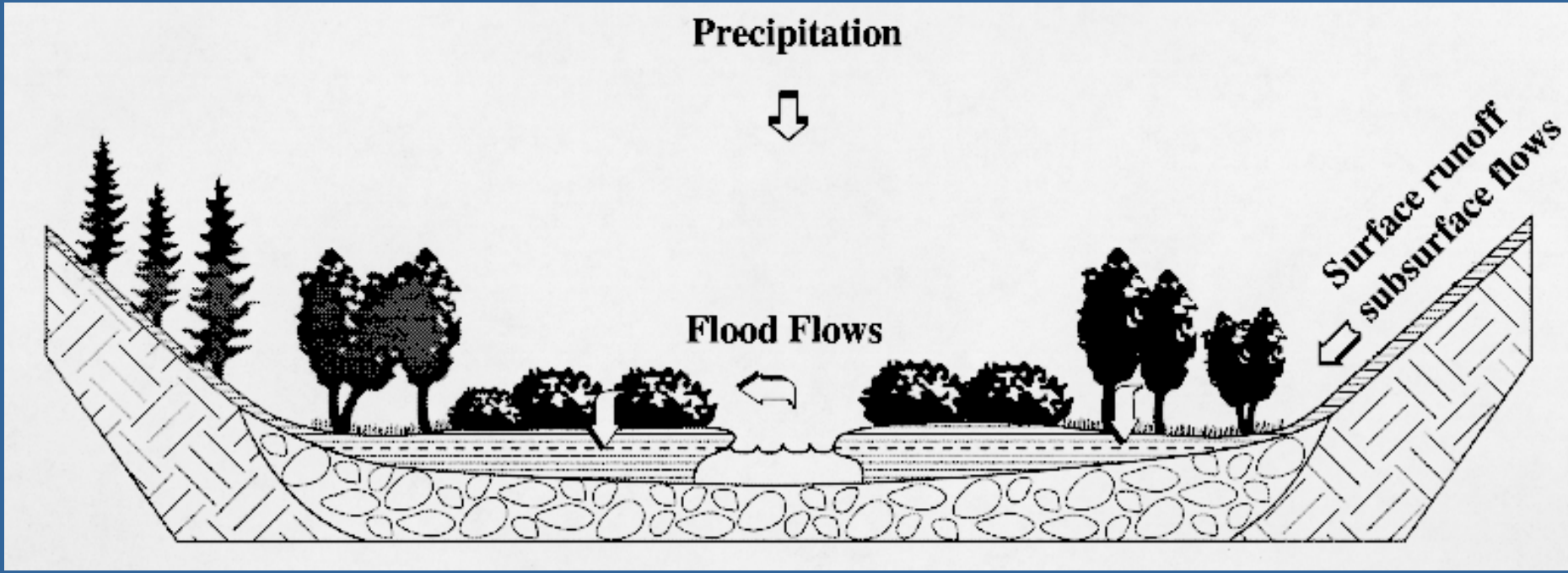
- Fibrists
- Saprists
- Folists
- Hemists

GELISOLS



Gelisols - Soils that commonly have a dark organic surface layer and mineral layers underlain by permafrost. These soils are commonly in the tundra regions of Alaska.

Riparian Soil Functions

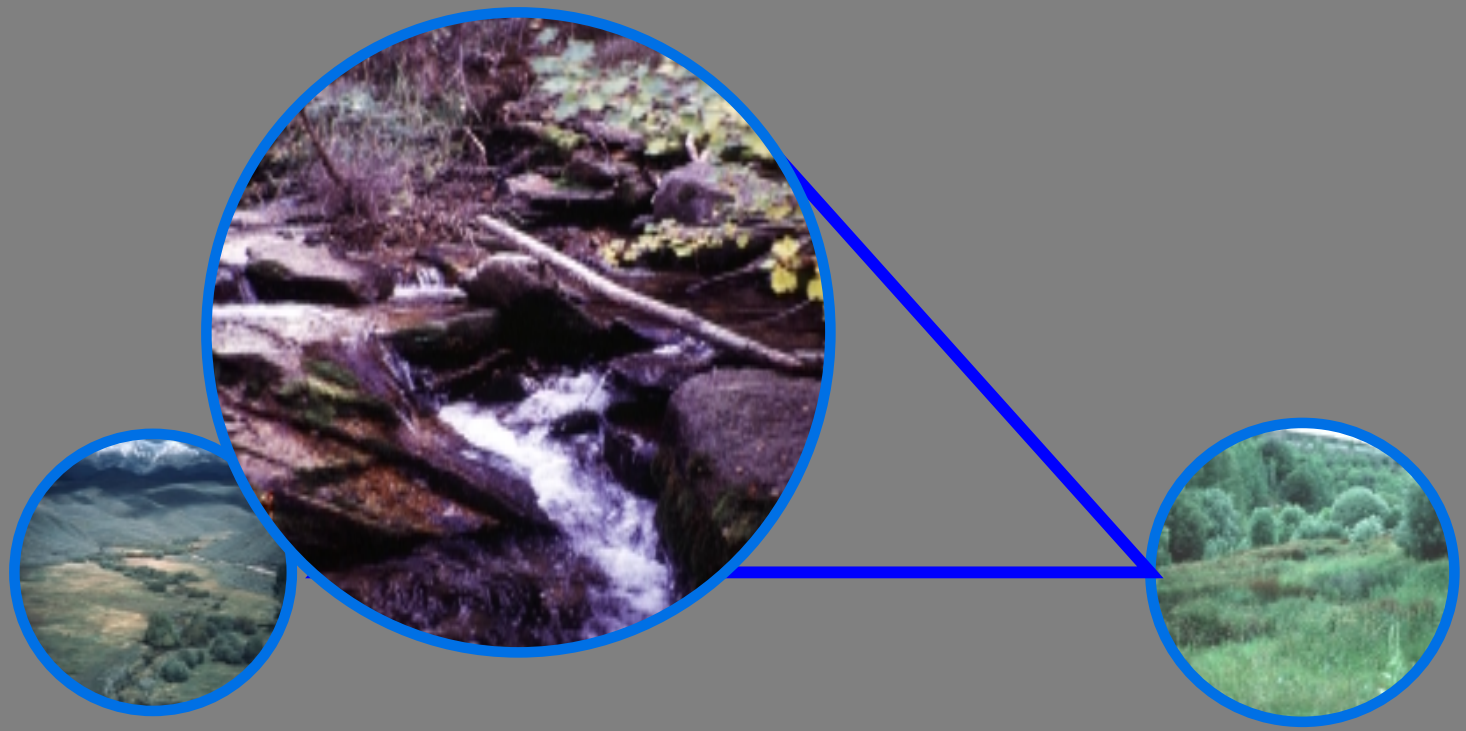


- Capture runoff from adjacent lands, water from high flows, and precipitation
- Infiltration of water into soil for gradual release into streams and to recharge ground water
- Serves as a medium for plants and microorganisms to cycle nutrients
- Stores nutrients otherwise discharged from the watershed

Filters pollutants


Montana sedge meadow

Relationship of Soils to Hydrology




Running water
(lotic) Riparian Soils

Tumalo Creek


Arizona


Cobble and gravel

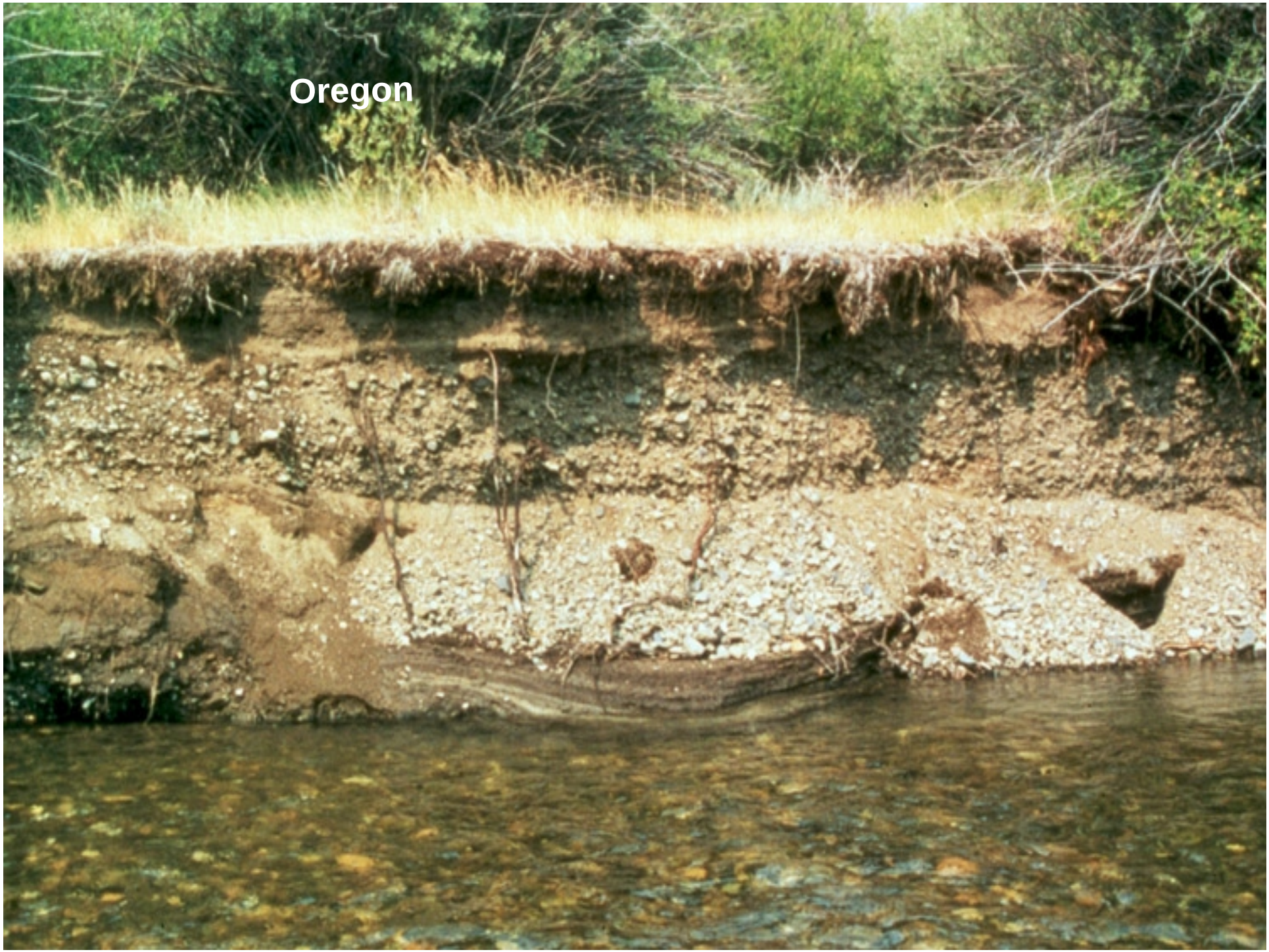

Small boulder and large cobble

Forested coastal stream - Oregon

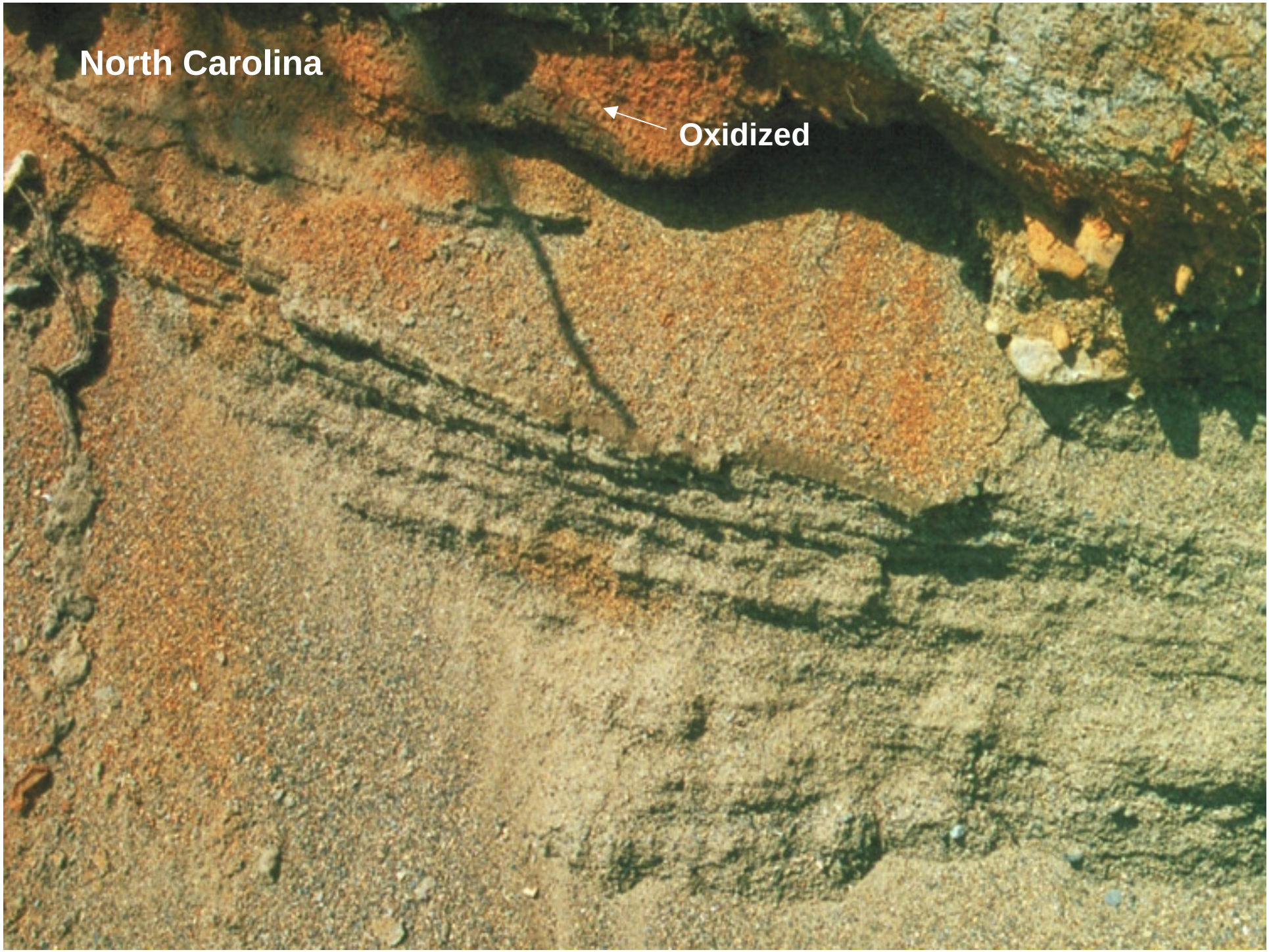

Alaska

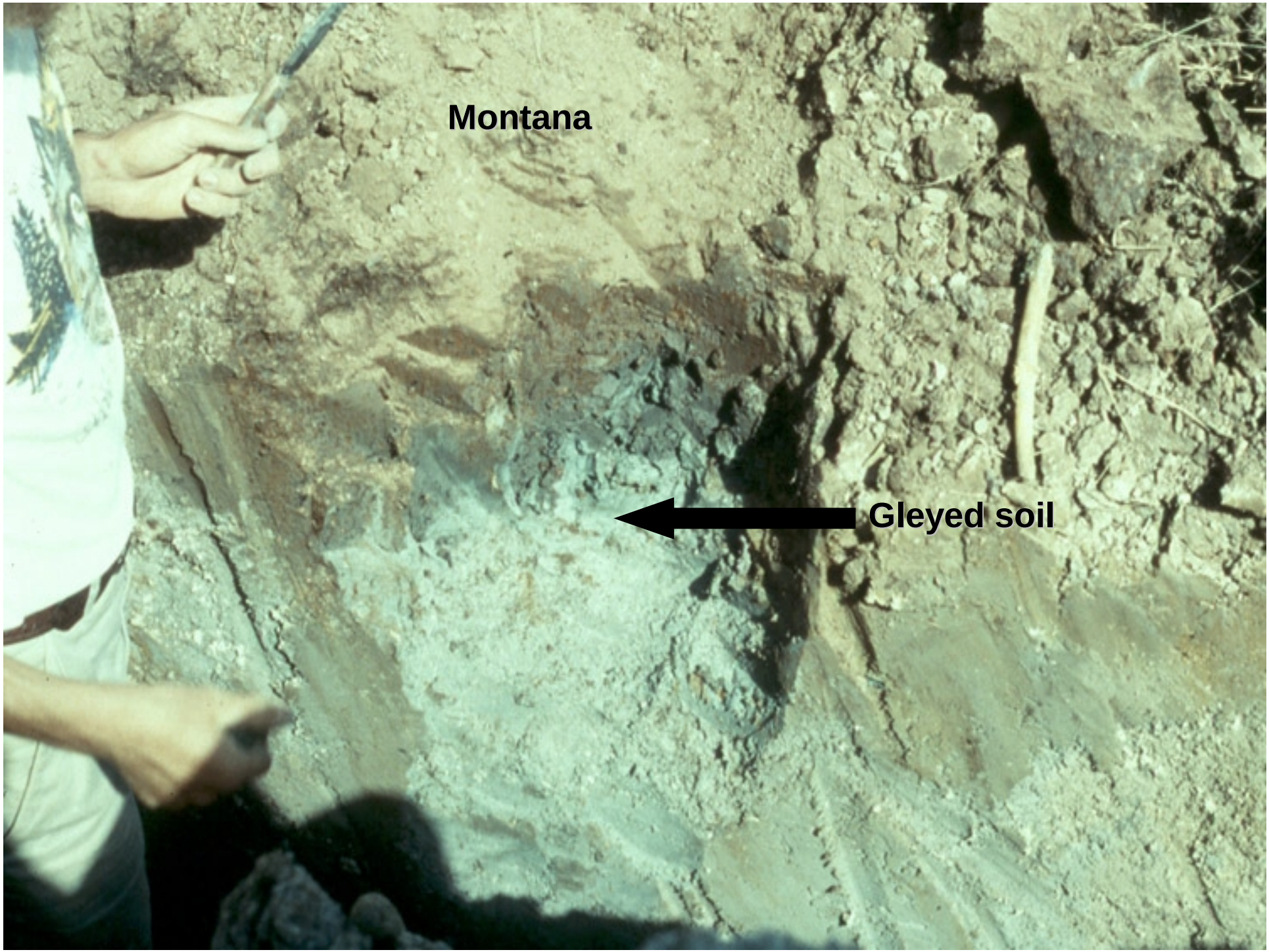

Alaska


Lotic


Oregon


Alaska


North Carolina
Oxidized

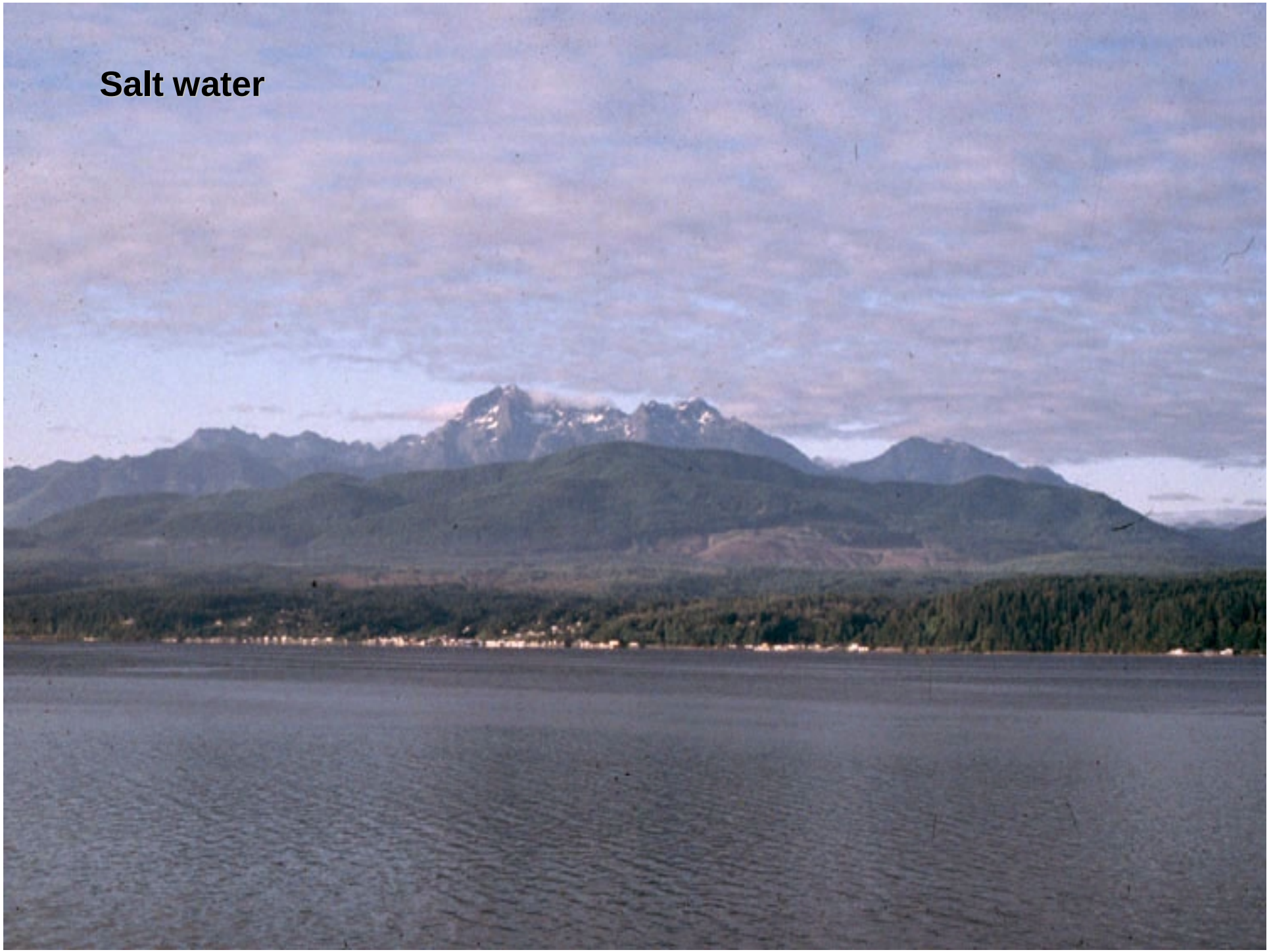

Montana
Gleyed soil

Gleyed layer

Oxidized iron


Cirque basin


Fresh water


Salt water


Montana - meadow


Alaska - slope
20
40
60
80


Toeslope


Riparian - forested


Depressional

Valley bottom

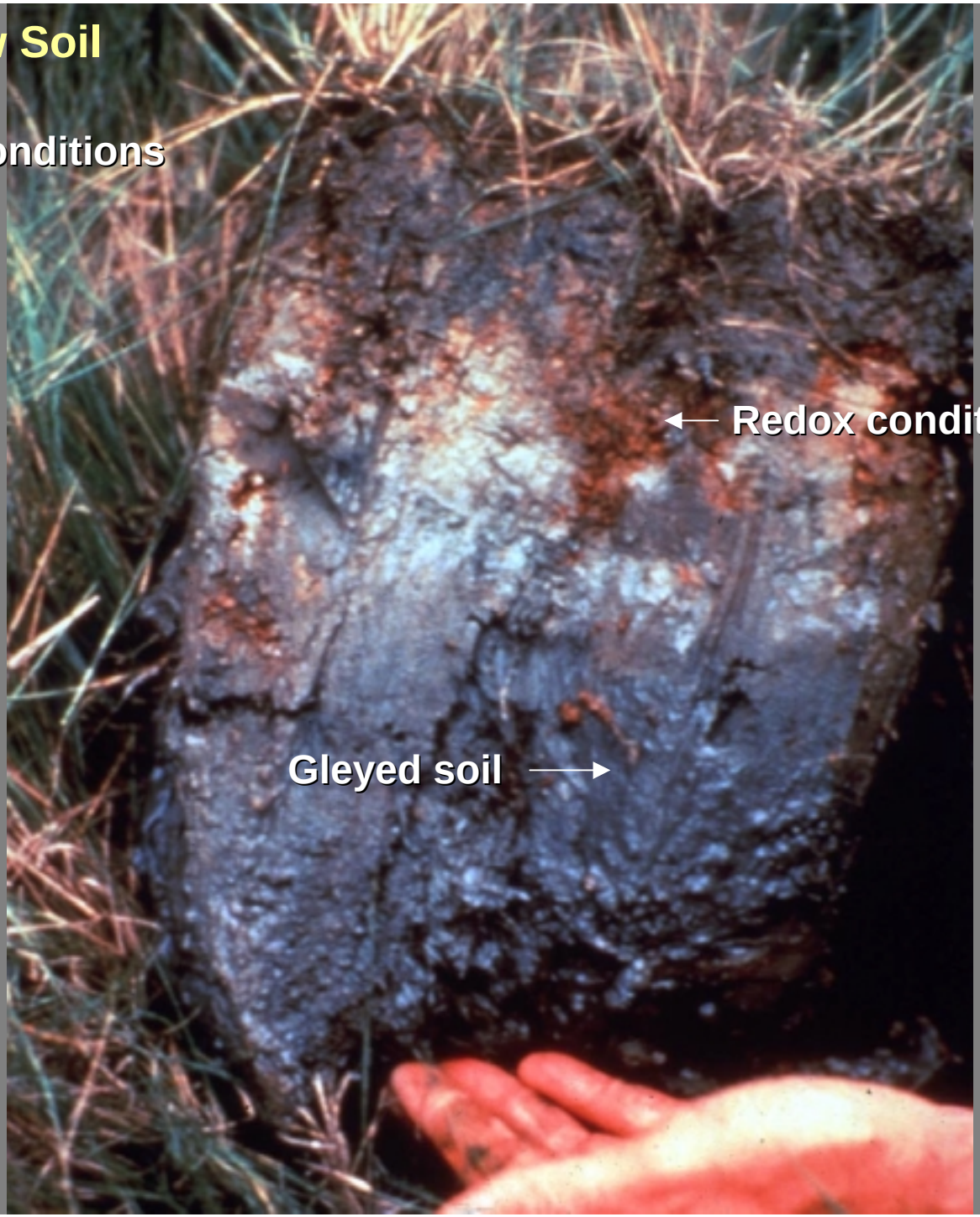

Wet meadow soil


Montana meadow


Perched water table

Wet Meadow Soil

Anaerobic conditions




Redox concentration


Alaska peat bog

Relationship of Soil to Vegetation


Conifer forest


Arizona


Slough Creek, Yellowstone NP


South Fork Skokomish River


Alaska


Woody Species (Willow)


East Washington State


Cattails and sedges

Soil Particle Size – Sand, Silt, Clay

SAND *feels gritty*

0.05 - 2.0 mm

SILT/CLAY *smooth between fingers*

< 0.05 mm

Coarse Fragments – Gravel, Cobble, Stone, Boulder

GRAVEL *fits in hand*

2.0 mm – 3 inches

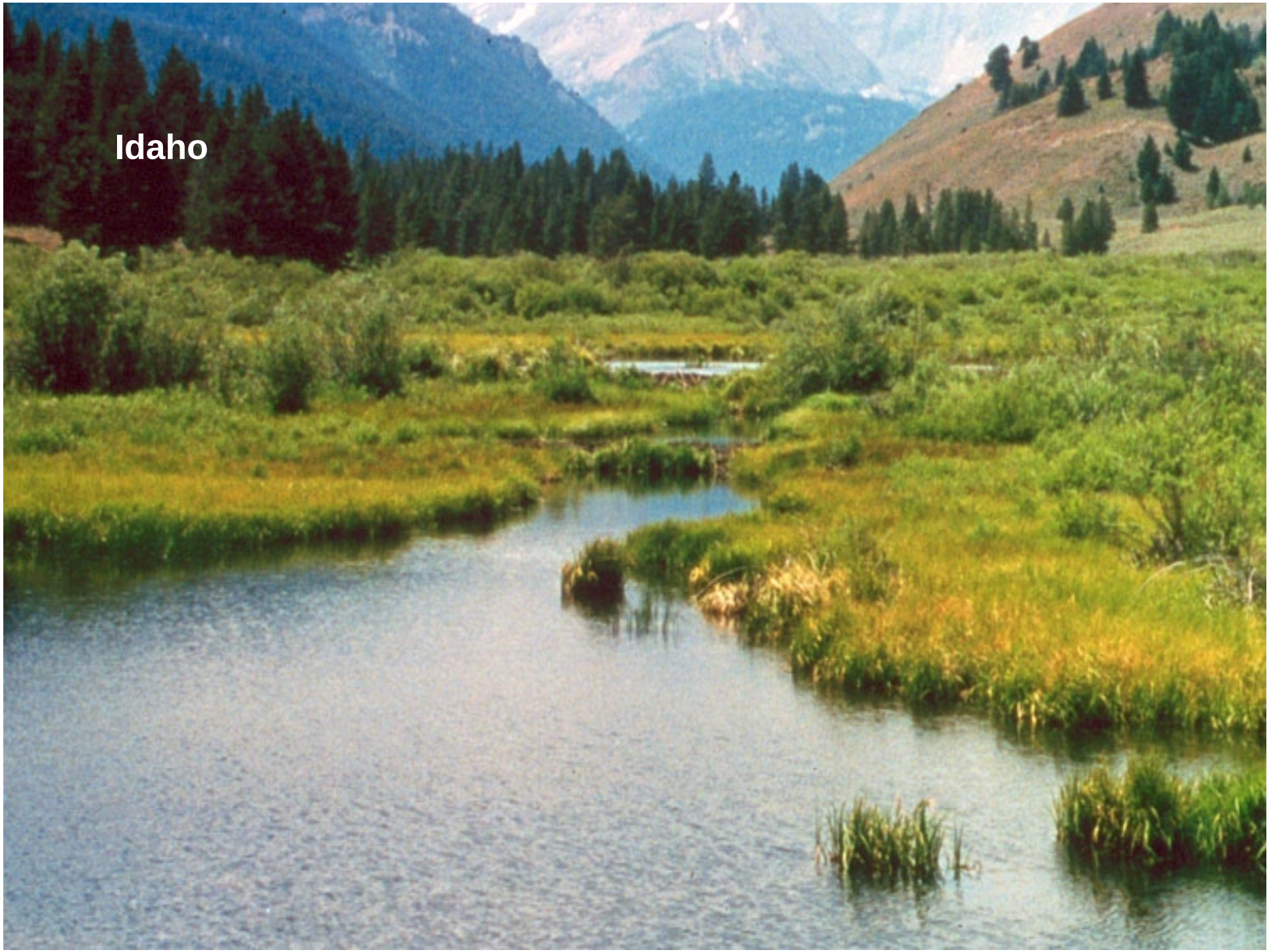
COBBLE

3 – 24 inches

BOULDER

> 24 inches

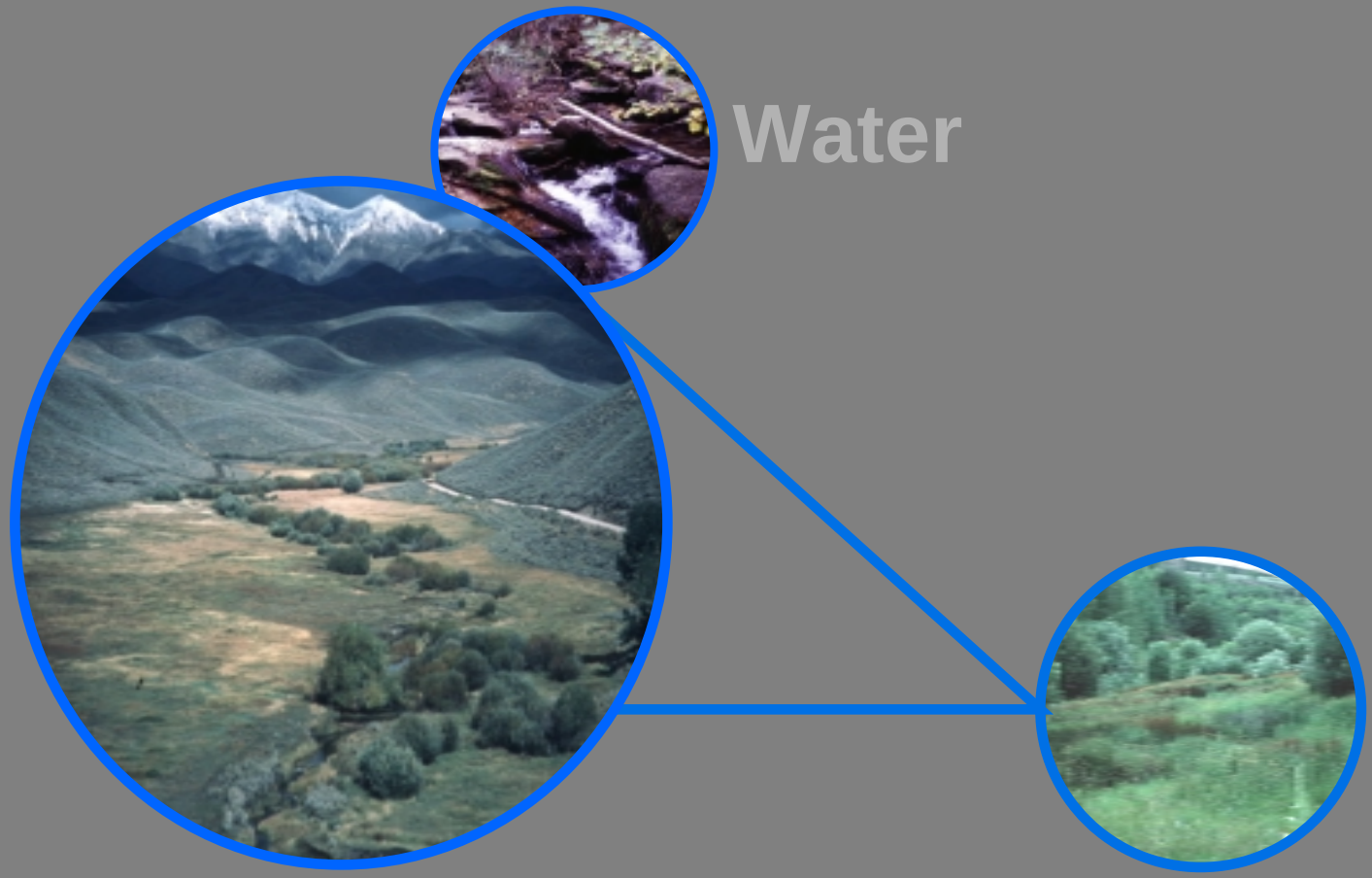

subalpine fir
Montana forested wetland
sedges


Idaho

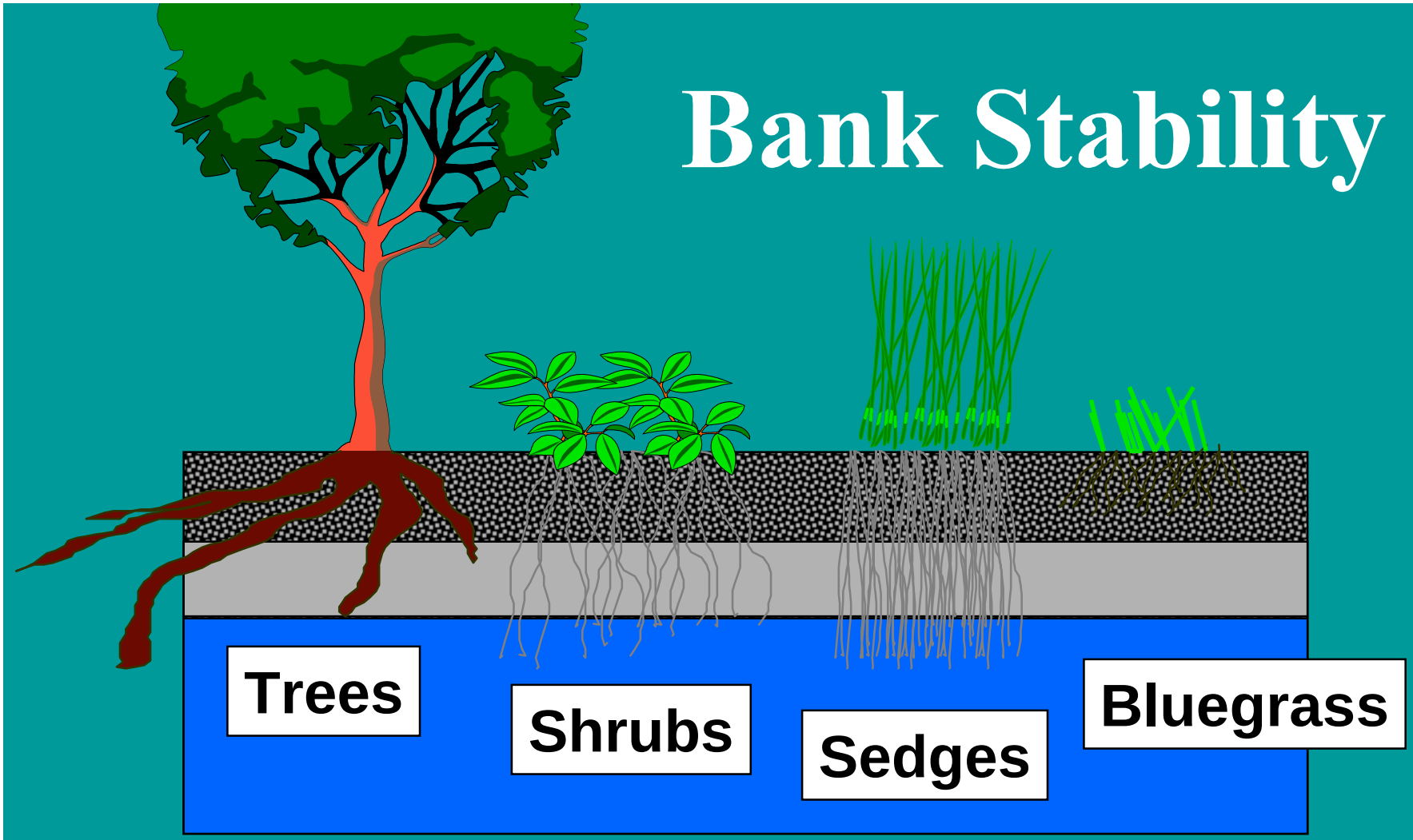

Washington


Capillary action

Relationship of Soil to Erosion and Deposition



Bank Stability

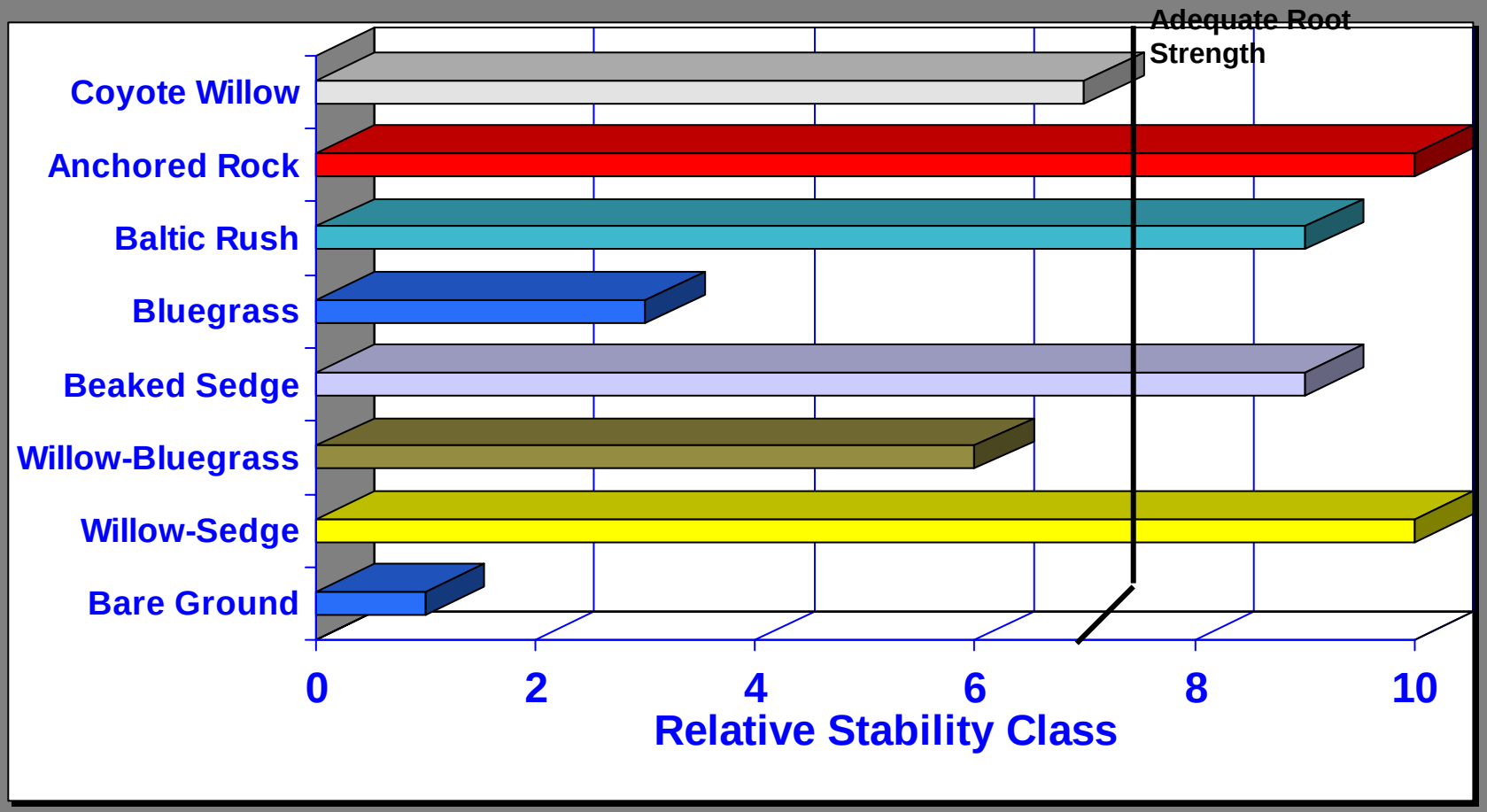


Rooting characteristics of plants are a critical component in stream bank stability

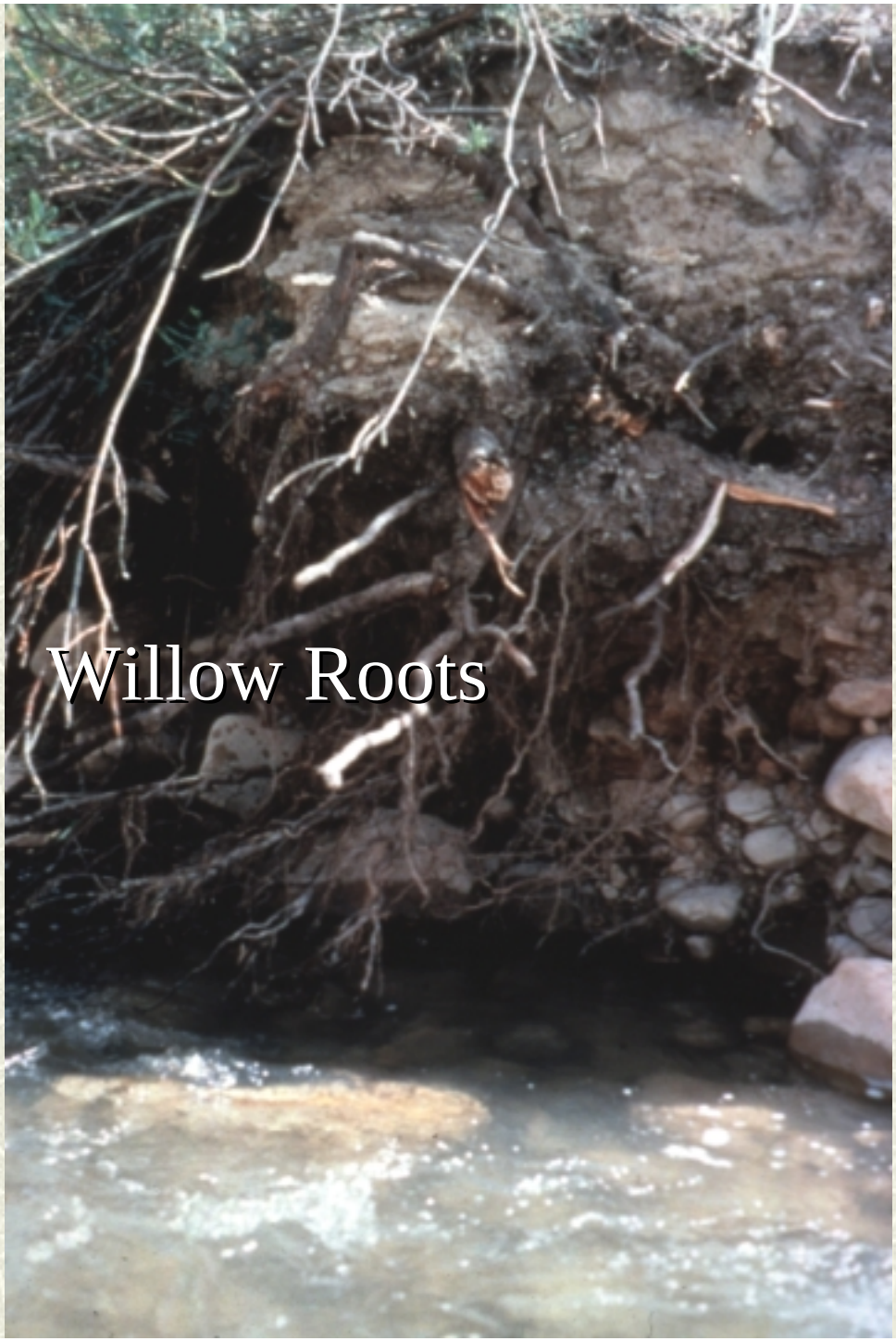

Idaho

Alaska

Channel Stability Rating (Vegetation)



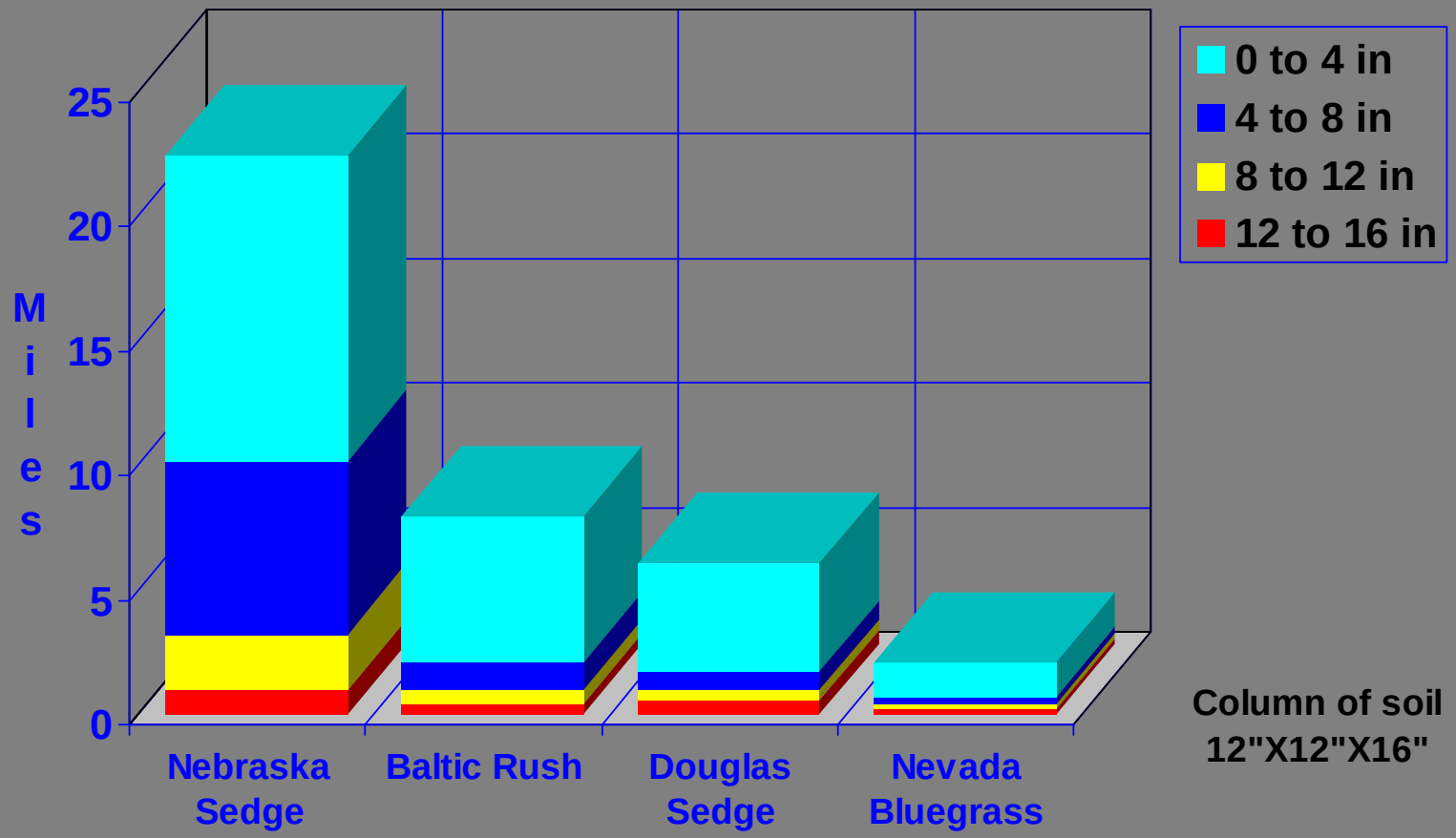
Winward 2000
Appendix B


Willow Roots


Sedges

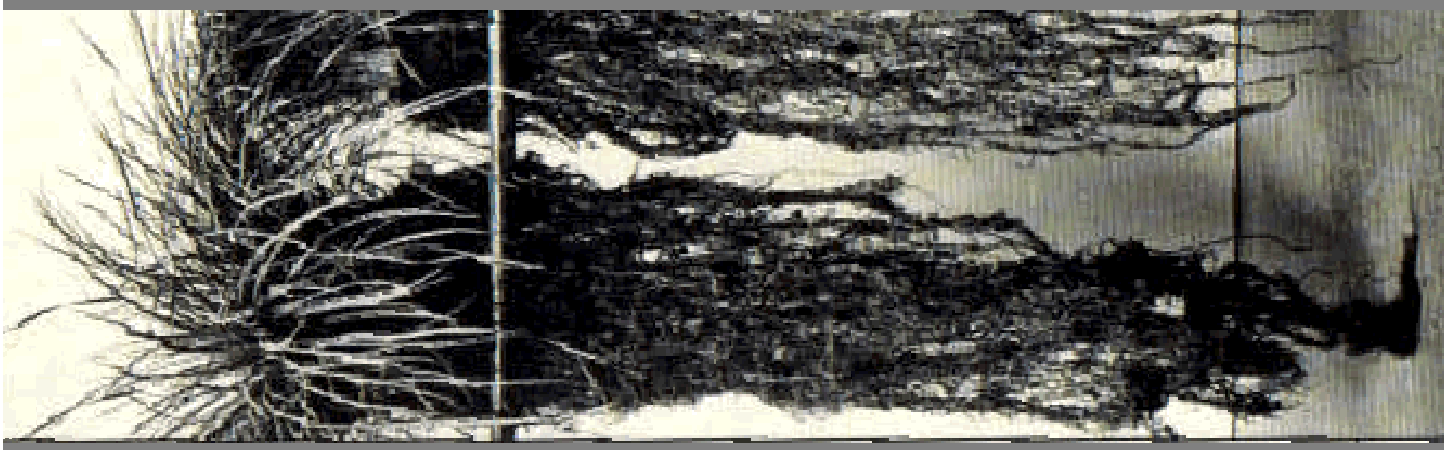

Pasture grasses

Root Length



Column of soil
12"X12"X16"

Manning, M.E., et al, 1989

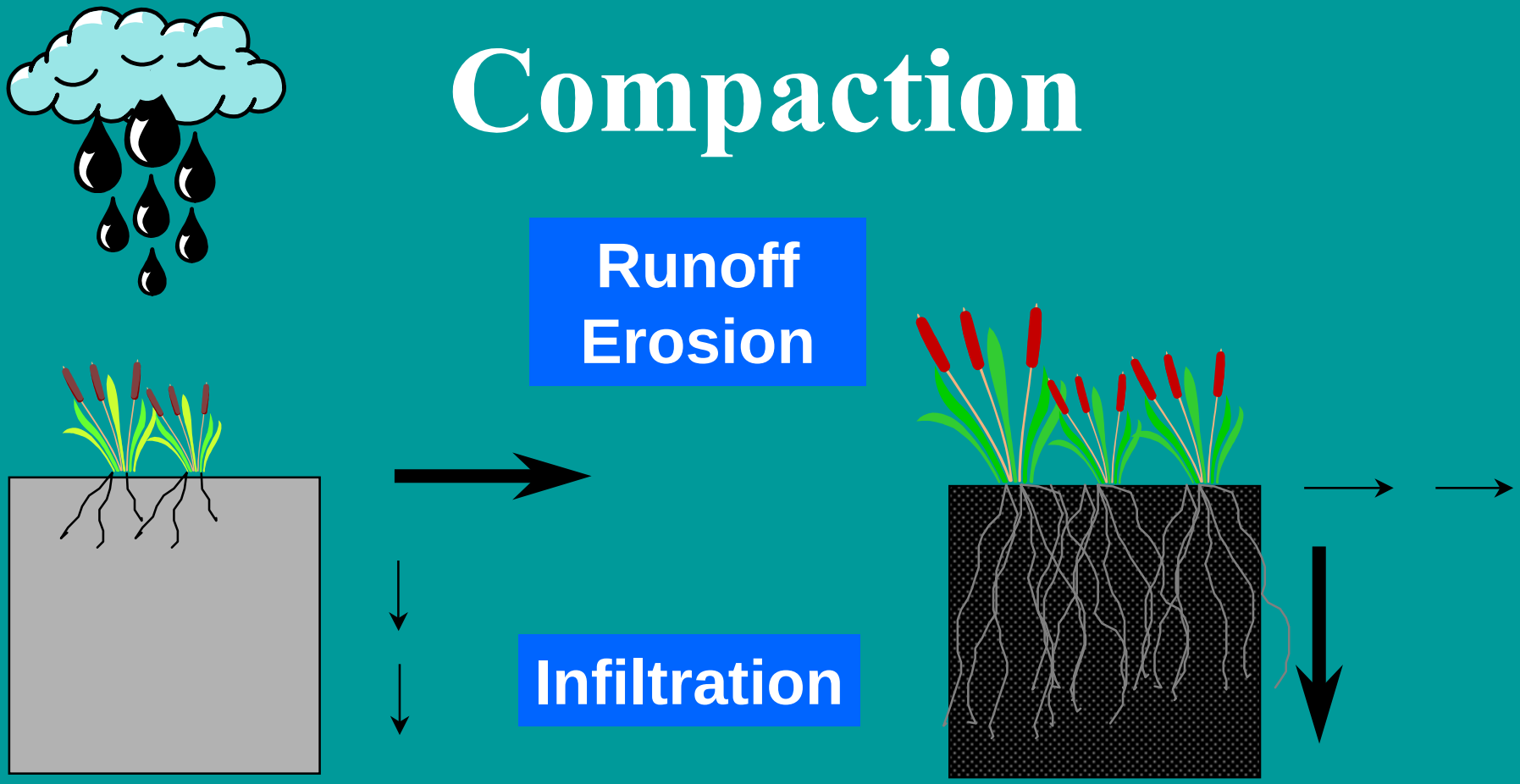



Shrub and boulder dominated system

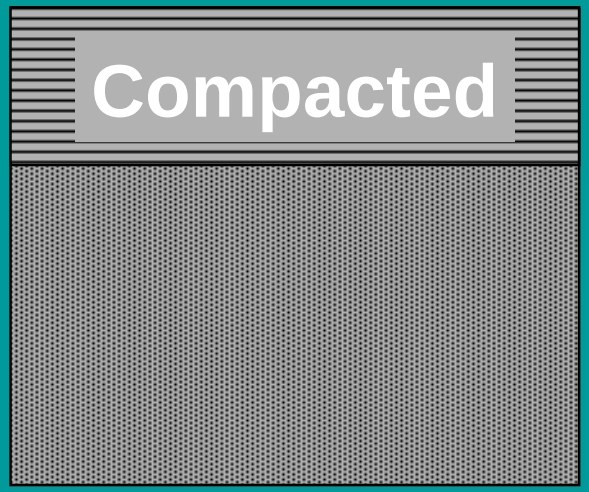

Oregon


Montana
Open water meadow

Effects of Compaction

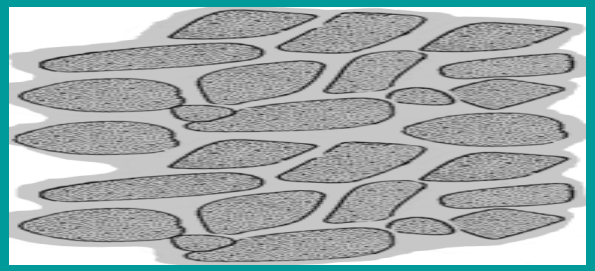


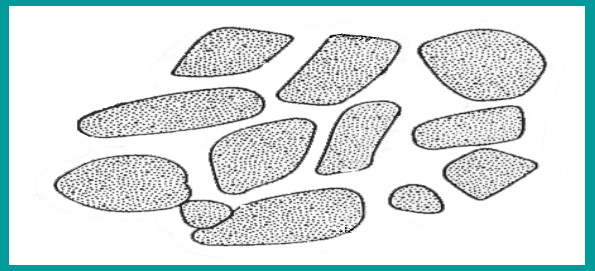
Soil Compaction and Texture



Fine textured

Coarse textured



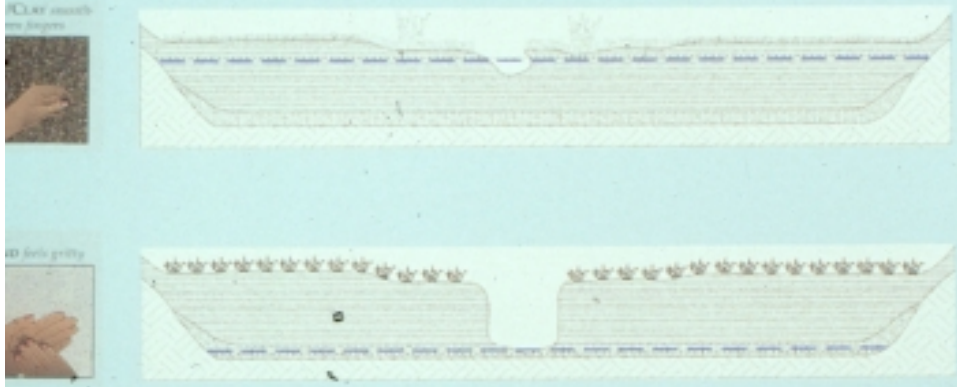



Compacted
“ Puddled” silty soil

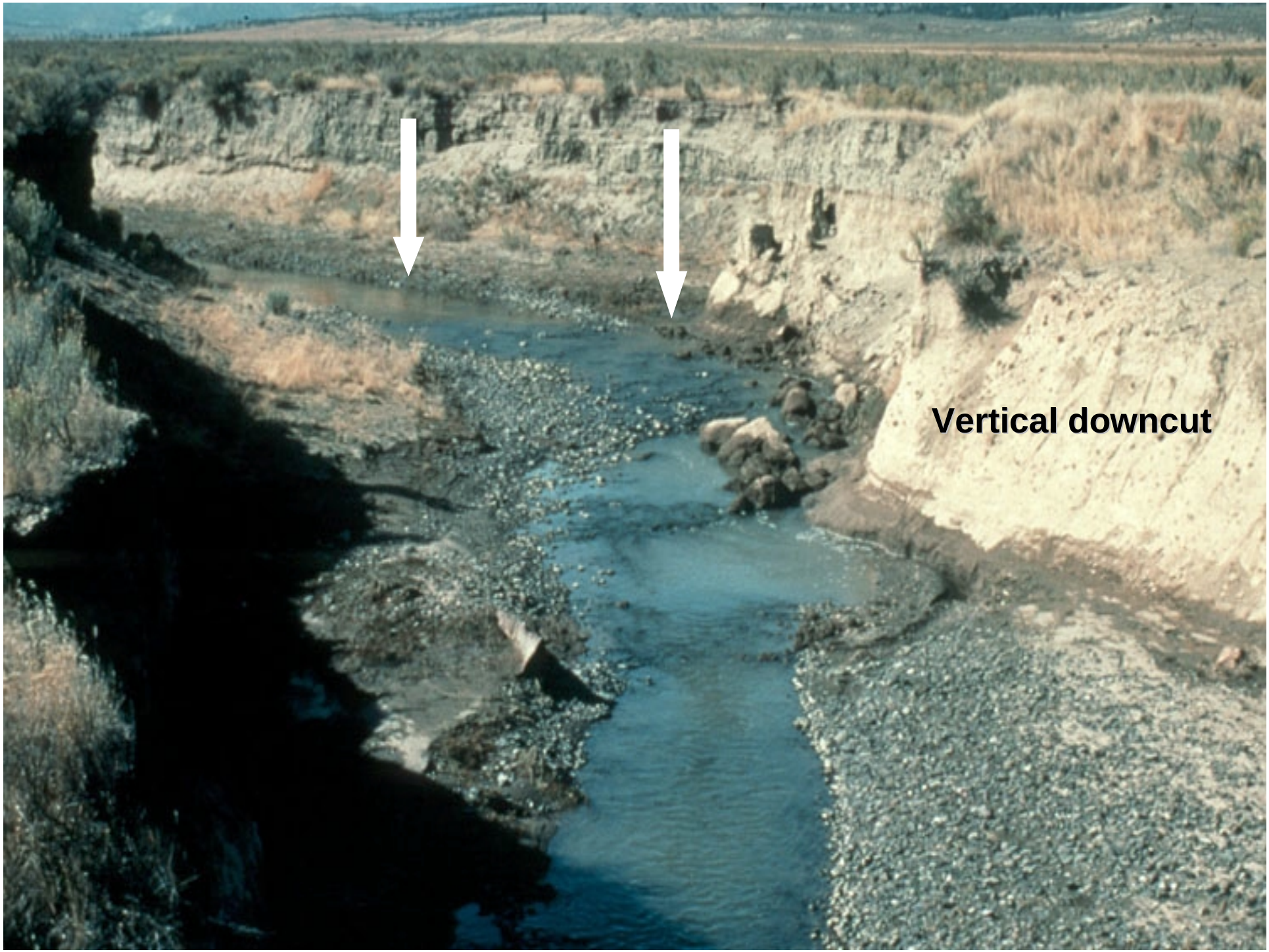

Shovel test

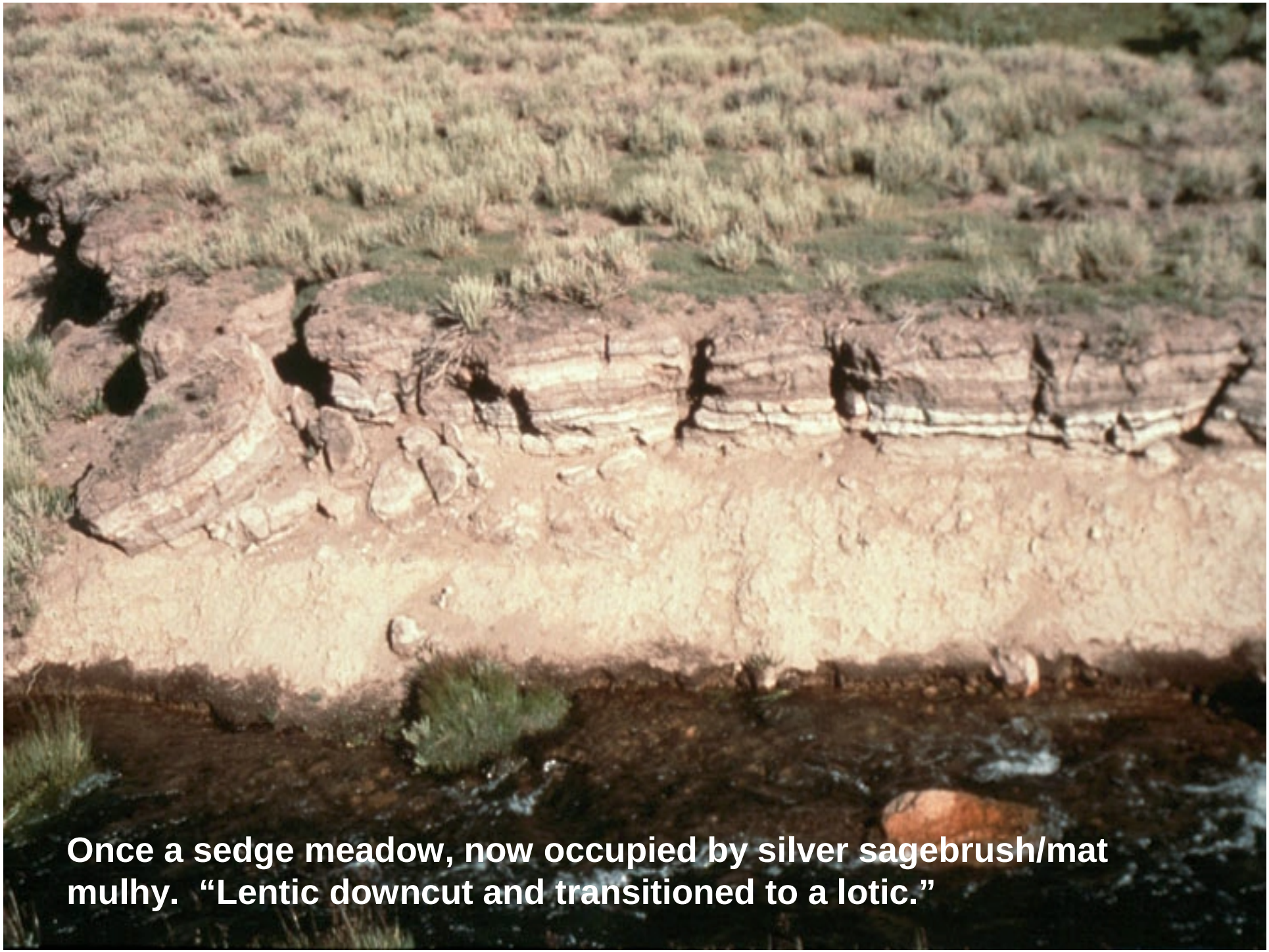
Soil Influence on Vertical and Lateral Channel Stability

Fine grained soils and parent material tend to be vertically unstable and subject to down cutting.



Coarse textured soils tend to be laterally unstable and subject to lateral migration across a valley bottom.


Vertical downcut



Once a sedge meadow, now occupied by silver sagebrush/mat mulhy. “Lentic downcut and transitioned to a lotic.”

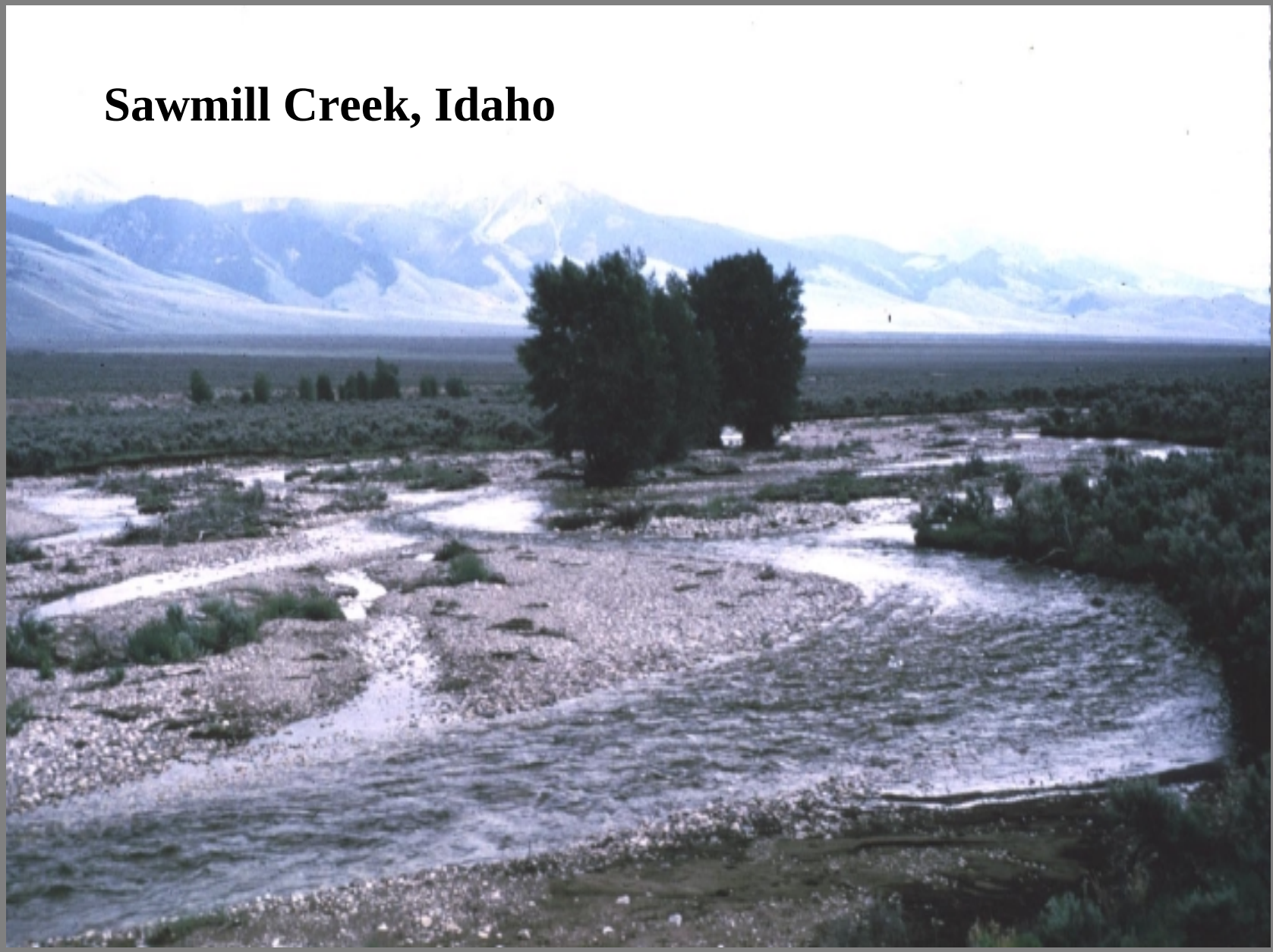

Compacted clay layer


Headcut


Idaho

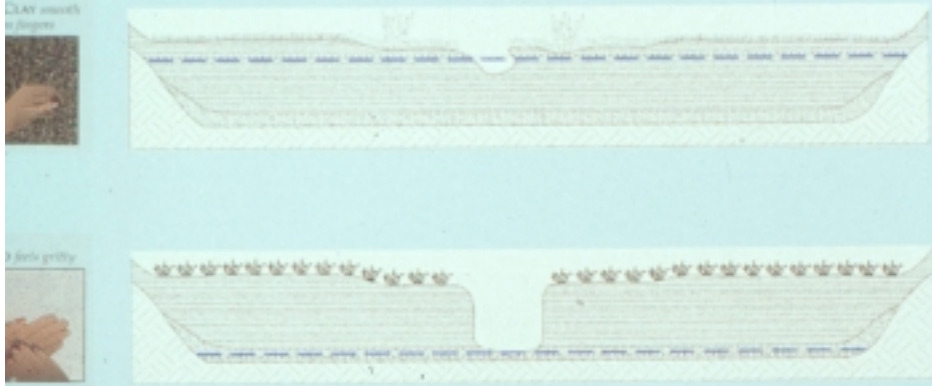

Oregon

Sawmill Creek, Idaho



Channel Stability

Fine grained soils and parent material tend to be vertically unstable and subject to down cutting.



Coarse textured soils tend to be laterally unstable and subject to lateral migration across a valley bottom.

Stages of Channel Progression

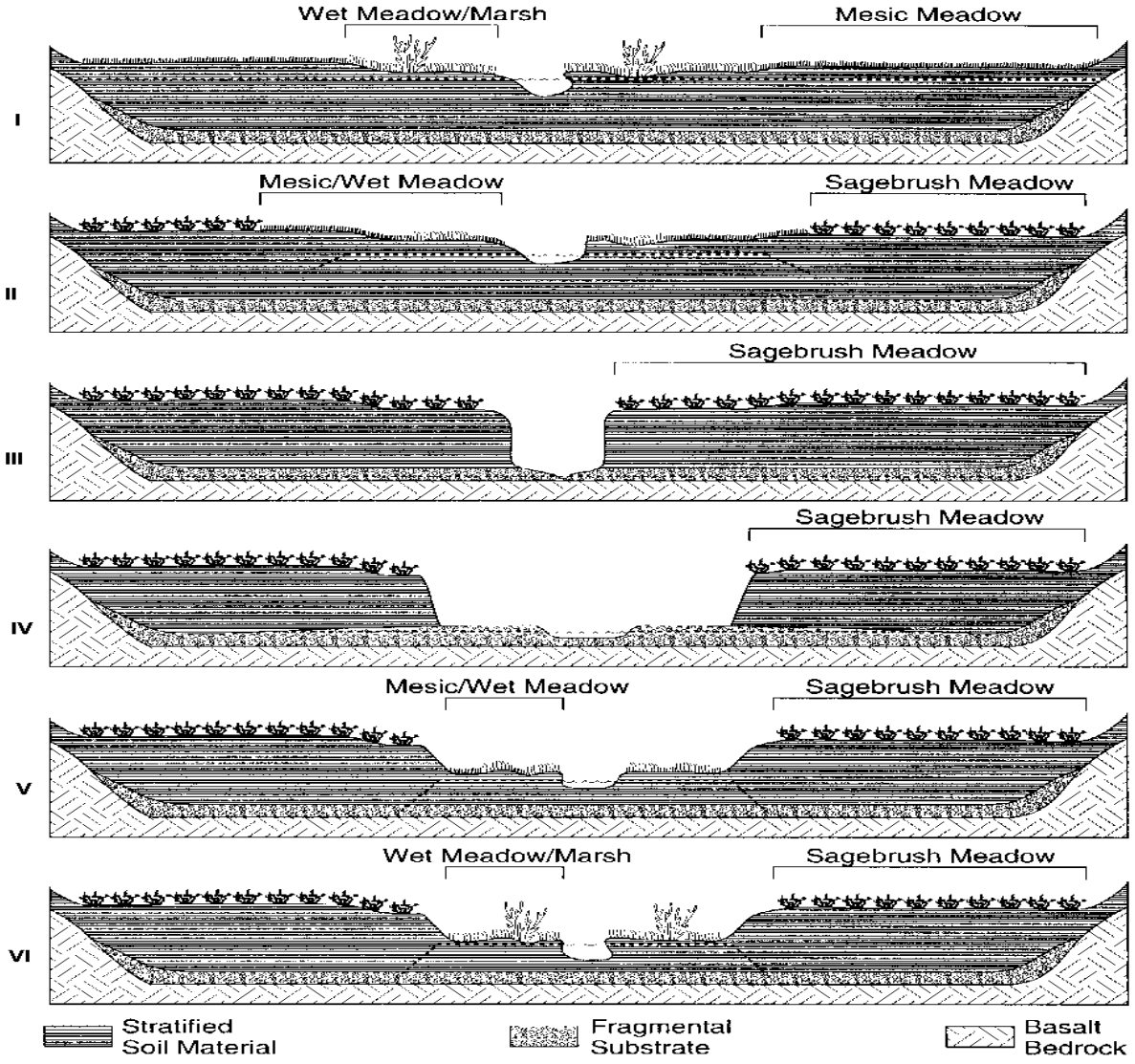
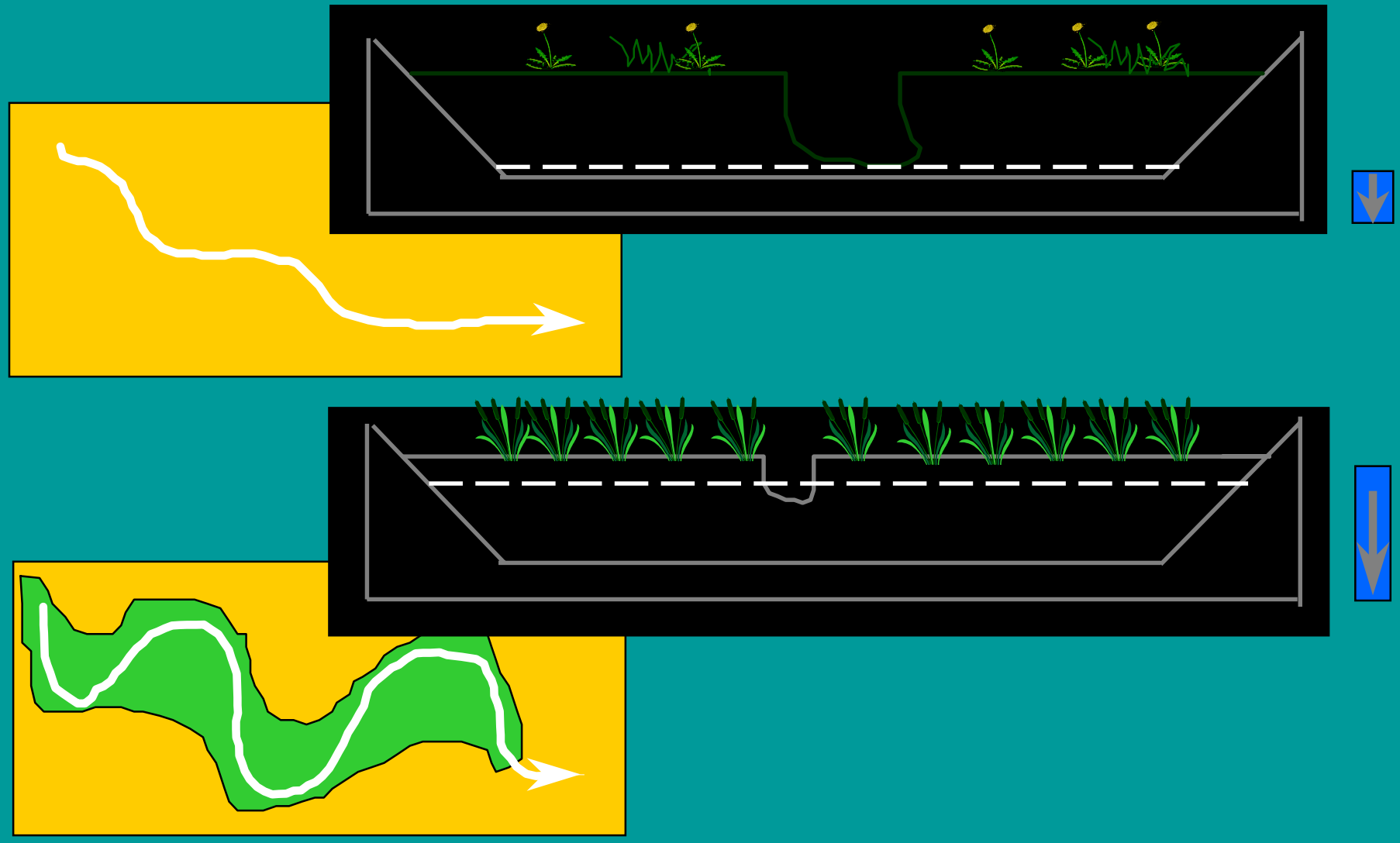


Figure 1. Succession of states for alluvial/nongraded valley-bottom type.

Keeping Water on the Land Longer Through Storage in Soil



Determining Potential and Extent of Riparian Areas


Kenai Peninsula, Alaska
Open water marsh

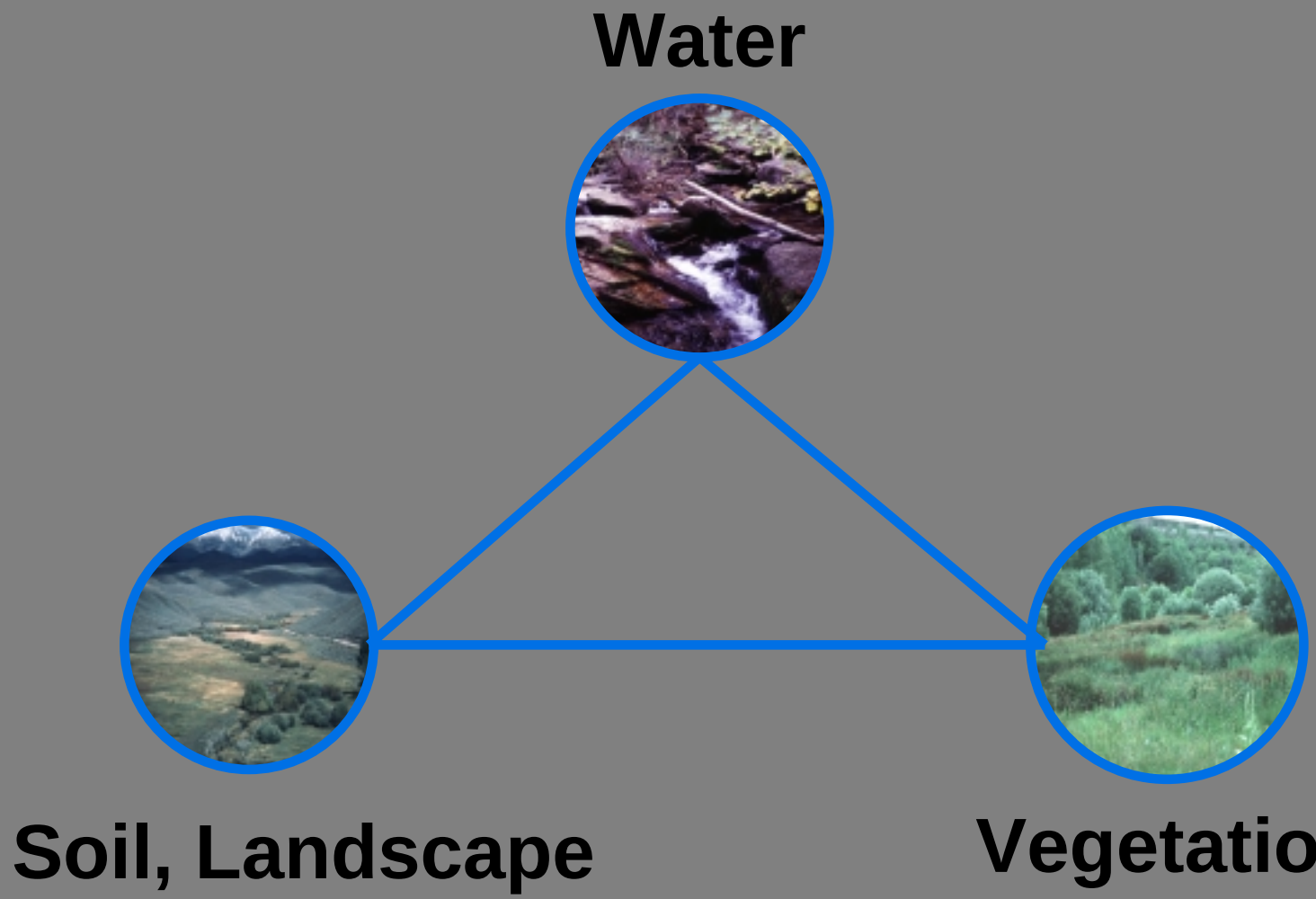

Lentic downcut and transitioned to a lotic


AK
1
20
40
60
Gleyed layer
Oxidized iron


Early 1900’s - Washington Coast


Water sedge in standing water

Natural Riparian Resources




“The late great Andy Watz”
CAT
JX CONST.
426-9179
E120B
RENTAL

Cooperative Riparian Restoration